PROCEEDINGS

OF THE

State Sanitary Convention

HELD AT

Philadelphia, May 12, 13 and 14, 1886,

UNDER THE AUSPICES OF THE

STATE BOARD OF HEALTH

AND VITAL STATISTICS

OF THE

COMMONWEALTH OF PENNSYLVANIA.

EXTRACTED FROM THE

SECOND ANNUAL REPORT

OF THE BOARD.

HARRISBURG:
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1888.

INTRODUCTORY NOTE.

At the regular meeting of the State Board of Health, held in Harrisburg, July 14, 1886, the committee of arrangements of the late State Sanitary Convention made its report, from which the following is an extract:

"The committee would report that in their opinion the convention was a great success, considering the fact that it was the first effort of the kind that had ever been made in this State. A glance at the programme will show that there were visitors present (many of whom read papers) from every section of the country, and the committee desires to place on record its heartfelt appreciation of the kindness of those who came from so far to help the first convention of this Board. While the personal attendance was not as large as would have been desirable, yet when we consider that the weather was very unfavorable (it rained nearly all the time), an audience at one time of nearly five hundred people (as estimated by the manager of the opera house) was very gratifying. But while the personal attendance was comparatively light, yet all the prominent newspapers of Philadelphia furnished such full reports of the proceedings (as evidenced by the scrap-book in the possession of the chairman) that we can safely say that there are very few persons in the State of Pennsylvania who are ignorant of the fact that this convention was held. So also, the prominent papers of other States fairly noticed the convention, and the committee again desires to place on record its appreciation of the exceedingly handsome manner in which the press of the country, and particularly of the State of Pennsylvania, and most particularly of the city of Philadelphia, seconded its efforts. The convention was visited during its sessions by most of the distinguished ladies and gentlemen whose names appear on the programme as vice presidents, and it is particularly gratifying to record the fact that all the sessions were well attended by ladies. The committee desires in an especial manner to return its thanks to His Excellency Hon Robert E. Pattison, Governor of this great Commonwealth, for his kindly interest in the convention and for his most happy and valuable opening address, an address commended on all sides for its sound sense and applicability. Our Governor made time from his pressing duties to sit through one whole session of the convention, and the committee feel that the great interest in their work that was displayed by the Chief Executive of this Commonwealth should be clearly placed on record, that future

generations may honor him who so ably and so earnestly upheld the State Board of Health in the days of its weakly infancy.

"To Dr. William Pepper, the distinguished Provost of the University of Pennsylvania, the president of our convention, who stole time from his engrossing labors to open our sessions and to eloquently portray the great importance of our work, we desire to return our sincere thanks.

"To the Hon. Erastus Brooks, of New York, who, though an invalid, journeyed in most inclement weather to deliver the 'annual address' before the Board; to Dr. Charles Smart, of the United States Army, who favored us with an admirable paper on 'water supply;' to the eloquent and forcible Dr. A. L. Gihon, who made so earnest and convincing an appeal for ample funds for sanitary work; to the able and earnest Dr. C. W. Chancellor, the distinguished Secretary of the State Board of Health of Maryland; to the genial Dr. H. B. Horlbeck, who journeyed from the Palmetto State to aid his sanitary brethren of the Keystone Commonwealth; to the broad-minded Dr. W. F. Hyer, who so instructively told us how the State Board of Health of Mississippi secured its munificent appropriation of $45,000 a year, and who truly added that in proportion to the size and wealth of the respective States, our Board should have $1,000,000 a year; to Dr. Carl H. Horsch, who so well portrayed the necessity of physical education; to the Lomb Prize Essayist from the West, Dr. Victor C. Vaughan, fo Michigan; to Colonel George E. Waring, of Newport; to Dr. Hugh Hamilton, of Harrisburg; to the Rev. Matson Meier Smith, who so appropriately and so fervently invoked the divine blessing on our labors; to Dr. W. S. Ross, of Kentucky; to Dr. Alfred Ludlow Carroll, of New York, whose statistical arguments are so convincing; to the practical sanitarian, Mr. Henry Lomb, who came all the way from Rochester to attend this convention, but who disappointed us by modestly retiring and preventing us from honoring him in person at the banquet; to the distinguished sanitarian, Dr. Henry B. Baker, of Michigan; to Dr. Lindsley, of Connecticut; to Dr. Charles Mitchell, of Tennessee; to Drs. Jackson Piper, James A. Stewart and John Morris, of Maryland; to Dr. D. W. Jefferis, of Chester; to Dr. J. Lowry Sibbett, of Carlisle; to the delegation from Allegheny county, —in a word, to all who aided us in the convention; to all whose names appear on the programme; to our fellow citizens, as well as to those who came from abroad; to the press and our audiences, and above all, to those philanthropic men and women who *practically* aided us with their money, the committee desires to return its heartiest thanks, and to place on record its grateful appreciation of their coöperation."

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JOSEPH F. EDWARDS, M. D.,
Chairman, Committee on Sanitary Convention.

PROCEEDINGS AND PAPERS OF THE STATE SANITARY CONVENTION, HELD AT PHILADELPHIA, MAY 12, 13 AND 14, 1886.

I. Preliminary announcement.

II. Programme.

III. Papers read before the convention.

1. Heredity and other Peculiarities affecting Health and Longevity—By C. W. Chancellor, M. D., Secretary of the State Board of Health of Maryland.

2. The Artificial Feeding of Infants—By John M. Keating, M. D., Visiting Obstetrician to the Philadelphia Hospital.

3. Economic Sanitation—By Albert L. Gihon, Medical Director United States Navy.

4. Sewering and Draining Cities—By George E. Waring, of Newport, R. I.

5. The Financial Aspect of Sanitation—By Alfred Ludlow Carroll, M. D., late Secretary of the State Board of Health of New York.

6. On the Sanitary Significance of Sporadic Typhoid Fever—By Pemberton Dudley, M. D., member of the State Board of Health.

7. The Progress of Sanitary Science in the State of Mississippi during the past ten years—By W. F. Hyer, M. D., member of the State Board of Health of Mississippi.

8. The Disposal of Human Excreta by Fire—By W. S. Ross, M. D., of Madisonville, Kentucky.

9. Physic-tippling and Medicine-bibbing; a Warning against Intemperance in the use of Drugs—By Frank Woodbury, M. D., Professor of Therapeutics, Materia Medica and Clinical Medicine in the Medico-Chirurgical College of Philadelphia.

10. Over-work and Sanitation in the Public Schools of Philadelphia, with Remarks on the Influence of Over-work in the Production of Nervous Diseases and Insanity—By Charles K. Mills, M. D., President of the American Neurological Association, etc.

11. The Necessity of Physical Education—By Carl R. Horsch, M. D., member of the State Board of Health of New Hampshire.

12. The Heating and Ventilation of Public School Buildings as Illustrated by the System Introduced into the New High School Building at Chester—By D. W. Jefferis, M. D., member of the school board of Chester.

13. Defective Vision in School Children—By Peter D. Keyser, M. D., Professor of Ophthalmology in the Medico-Chirurgical College of Philadelphia.

14. An Epidemic of Diphtheria traced to its Source—By Benjamin Lee, M. D., Secretary of State Board of Health of Pennsylvania.

15. The Hygiene of Old Age—By H. C. Wood, M. D., Professor of Materia Medica and Therapeutics in the University of Pennsylvania.

16. Our Drugs and Medicines—By L. Wolf, M. D., President of the Philadelphia Pharmaceutical Examining Board, etc.

17. On Continuous Preventive Disinfection of House Drainage—By Henry Hartshorne, M. D., of Philadelphia.

18. A Plea for more Prolonged Isolation in the Management of Scarlet Fever—By W. W. Vinnedge, M. D., of Lafayette, Indiana.

19. What the State owes to the People and the People to the State; the Annual Address before the State Board of Health of Pennsylvania—By the Hon. Erastus Brooks, a member of the New York State Board of Health.

20. Remarks on Vaccination—By W. M. Welch, M. D., Physician to the Municipal (Small-pox) Hospital of Philadelphia.

21. The Present and Prospective Sanitary Condition of Pittsburgh, Pennsylvania—By Crosby Gray, Health Officer of Pittsburgh.

22. The Water Supply of Philadelphia—By J. Cheston Morris, M. D., of Philadelphia.

23. On Wholesome Water for Cities and Towns—By Charles Smart, M. D., Major and Surgeon, United States Army.

24. The Quality of the Water Supply of Philadelphia as tested by Vital Statistics—By Richard A. Cleeman, M. D., Philadelphia.

25. Influence of Diet on Health—By Alfred K. Hills, M. D., of New York city.

26. House and Yard Ventilation—By W. C. Van Bibber, of Baltimore, Maryland.

27. Forced Ventilation *vs.* Natural Ventilation (or Ventilation by Heat)—By Russell Thayer, C. E., of Philadelphia.

28. The Majesty of Law in Sanitation—By J. Andrew Harris, D. D., of Philadelphia.

29. Filtration of Drinking Water a Vital Necessity—By Charles F. Wingate, Sanitary Engineer.

30. Narcotics and the Appetites which they Produce—By R. Lowry Sibbet, A. M., M. D., of Carlisle, Pennsylvania.

31. Technics of Animal Vaccination—By W. L. Zuill, M. D., D. V. S., Professor of Surgery and Obstetrics, Veterinary Department, of the University of Pennsylvania.

32. Importation of Foreign Rags into American Ports—By F. S. Wilson, M. D., late Lazaretto Physician at the Port of Philadelphia.

I. PRELIMINARY ANNOUNCEMENT.

A Sanitary Convention, the object of which will be to afford an opportunity for an expression of opinion on matters relating to the public health and the discussion of methods looking towards an advancement in the sanitary condition of the Commonwealth, the prevention of sickness and avoidable death, and the improvement of the conditions of living, will be held in Philadelphia, under the auspices of the State Board of Health, on Wednesday, Thursday and Friday, May 12, 13 and 14, 1886.

The address of welcome will be delivered by His Excellency, Hon. Robert E. Pattison, Governor of Pennsylvania.

The following will be among the subjects that will be discussed by prominent sanitarians:

1. The sanitary needs of school buildings and grounds.
2. The water supply of towns and cities.
3. The water supply of Philadelphia.
4. The disposal of slops, garbage, refuse, etc.
5. The prevention of communicable diseases.
6. The influence of clothing on health.
7. Ventilation.
8. The drainage and sewerage of cities and towns.
9. The drainage and sewerage of Philadelphia.
10. The influence of diet on health.
11. The relations of christianity to health.
12. Mistakes in school architecture.
13. Defective vision in school children: Causes and management.
14. The necessities of physical education.
15. Drainage and sewerage in country districts.
16. Sanitary science in villages.
17. Municipal sanitation.
18. Artifical feeding of infants.
19. Condensed milk.
20. Various artificial baby foods.
21. The inheritance of disease.
22. Hygiene of the home.
23. Sanitary plumbing and drainage.
24. Tests for impurities in water: The use of filters.
25. Germicides.
26. Vaccination.
27. The hygiene of old age.

28. Cholera.

29. City *versus* country life, from a hygienic point of view.

The public are cordially invited to take part in and help to make a success of this convention.

At a later date a circular of details will be issued.

JOSEPH F. EDWARDS, M. D.
Chairman Committee of Arrangements.
224 S. 16th St., Philadelphia, Pa.

II. PROGRAMME.

State Sanitary Convention under the auspices of the State Board of Health, in McCaull's Opera House, Broad Street below Locust, Philadelphia, Wednesday, Thursday and Friday, May 12th, 13th and 14th, 1886.

The object of the Convention will be to afford an opportunity for an expression of opinion on matters relating to the public health and the discussion of methods looking towards an advancement in the sanitary condition of the Commonwealth, the prevention of sickness and avoidable death, and the improvement of the conditions of living.

Organization of the Convention.

PRESIDENT.

William Pepper, M. D., LL. D., Provost of the University of Pennsylvania.

VICE PRESIDENTS.

Hon. William B. Smith, Mayor of Philadelphia.
Hon. James Pollock, }
Hon. J. F. Hartranft, } ex-Governors of Pennsylvania.
Hon. Henry M. Hoyt, }
Hon. Richard Vaux, }
Hon. Samuel G. King, } ex-Mayors of Philadelphia.
Hon. A. F. Mizener, Mayor of Erie, Pa.
Hon. Lewis C. Cassidy, Attorney General of Pennsylvania.
Hon. William S. Stenger, Secretary of the Commonwealth of Pennsylvania.
Hon. J. Simpson Africa, Secretary of Internal Affairs of Pennsylvania.
Hon. Jerome B. Niles, Auditor General of Pennsylvania.

Hon. James I. Mitchell, Judge Court Common Pleas.
Hon. James Gay Gordon, Judge Court Common Pleas.
Hon. James H. Campbell, ex-Postmaster General United States.
Hon. Robert Adams, State Senator.
Hon. A. K. McClure, editor *Times*.
Right Rev. William Bacon Stevens, D. D.
Right Rev. Edmund de Schweinitz, D. D., Bethlehem, Pa.
Right Rev. Cortlandt Whitehead, D. D., Pittsburgh. Pa.
General Presley N. Guthrie, Adjutant General of Pennsylvania.
General J. P. S. Gobin, Lebanon, Pa.
General George R. Snowden, Philadelphia, Pa.
Colonel Richard S. Edwards, Quartermaster General of Pennsylvania.
Mr. Charles Emory Smith, editor *Press*.
Mr. Robert S. Davis, proprietor *Call*.
Mr. Louis N. Megarge, editor *News*.
Mr. William M. Singerley, proprietor *Record*.
Dr. Daniel G. Brinton, editor *Medical and Surgical Reporter*.
Mr. L. Clarke Davis, *Inquirer*.
Mr. James R. Gates, President Select Council, Philadelphia.
Mr. Charles Lawrence, President Common Council, Philadelphia.
Mr. John Bradsley, Chairman Finance, Common Council.
Colonel William Ludlow.
Mr. H. G. Sickel, President Board of Health of Philadelphia.
Mr. A. A. Hirst, Secretary Board of Health of Philadelphia.
Mr. John Wanamaker.
Col. Robert P. Dechert, Controller of Philadelphia.
Major Moses Veale, Health Office of Philadelphia.
Dr. Wm. M. Welch, Physician in charge Municipal Hospital, Philadelphia.
Dr. Henry Leffmann, Port Physician.
Dr. F. S. Wilson, Lazaretto Physician.
Dr. Roberts Bartholow, Dean Jefferson Medical College.
Dr. A. R. Thomas, Dean Hahnemann Medical College.
Dr. P. D. Keyser, Dean Medico-Chirurgical College.
Dr. Rachel L. Bodley, Dean Women's Medical College of Pennsylvania.
Dr. R. J. Levis, President Philadelphia County Medical Society.
Dr. William H Pancoast, Emeritus Professor of Anatomy, Jefferson Medical College.
Dr. D. Hayes Agnew, Professor of Surgery, University of Pennsylvania.
Dr. William B. Atkinson, Secretary American Medical Association.
Dr. P. H. Bailhache, U. S. M. H. S.
A. H. Fetterholf, Ph. D., President Girard College.
Mr. Samuel C. Perkins, President Public Building Committee.

Mr. Wm. B. Land, Secretary Public Building Committee.
Mr. John Gay, President Commissioners of Fisheries.
Mr. Samuel D. Smedley, Chief Engineer and Surveyor of Philadelphia.
Mr. William Dixey, Commissioner Markets and City Property, Philadelphia.
Mr. Cadwalader Biddle, Secretary Board of Public Charities.
Mr. George A. Cotton, President Board of Port Wardens.
Mr. Christopher Stuart Patterson, Secretary Eastern Penitentiary.
Mr. Frederic Collins, President House of Refuge.
Mr. A. M. Spangler.
Mr. W. Heyward Drayton, President Directors City Trusts.
Mr. Richard L. Ashhurst.
Captain W. Stokes Boyd.
Mrs. E. D. Gillespie.

Programme.

Owing to the large number of papers to be read, the Committee earnestly request the participants to adhere closely to the apportionment of this programme. The audience are invited to take part in the discussions, which must be limited to *five minutes* for each participant.

WEDNESDAY, MAY 12.

Morning Session.

10 A. M. Prayer by the Revd. Matson Meier-Smith, D. D., Professor in the Philadelphia Divinity School.

Introductory remarks by the President.

Address of welcome by His Excellency Robert E. Pattison, Governor of Pennsylvania.

11 A. M. "Prevention of Communicable Diseases." By Morton Prince, M. D., of Boston, Mass.

11.30 A. M. "An Epidemic of Diphtheria Traced to its Source." By Benjamin Lee, A. M., M. D., Secretary State Board of Health of Pennsylvania.

12 M. "Tests for Impurities in Water." By H. F. Formad, M. D., of Philadelphia, Lecturer on Experimental Pathology, University of Pennsylvania.

12.30 P. M. "Necessity of Physical Education." By Carl H. Horsh, M. D., of Dover, N. H., Member State Board of Health of New Hampshire.

Afternoon Session.

2 P. M. "Importation of Foreign Rags into American Ports." By F. S. Wilson, M. D., Lazaretto Physician.

2.30 P. M. "Heating and Ventilation of Public School Buildings," as illustrated by the system introduced into the new High School Building at Chester. By D. W. Jefferis, M. D., of Chester, Pa.

3 P. M. "Narcotic Appetites." By J. Lowry Sibbett, M. D., of Carlisle, Pa.

3.30 P. M. "Economic Sanitation." By Albert L. Gihon, M. D., Medical Director, U. S. N.

4.00 P. M. "Our Drugs and Medicines." By. L. Wolff, M. D., President Pharmaceutical Examining Board of Philadelphia.

4.30 P. M. "Physic Tippling and Medicine Bibbing," a Warning against Intemperance in the Use of Drugs. By Frank Woodbury, M. D., Professor of Materia Medica and Therapeutics in the Medico-Chirurgical College of Philadelphia.

5 P. M. "Healthy Dwellings." By V. C. Vaughan, M D., of Ann Arbor, Michigan, Member Michigan State Board of Health.

Discussion by Mr. George N. Bell, C. E., of Newport, R. I. Mr. William B. Land, Secretary Public Building Commission, Philadelphia. A. R. Thomas, M. D., Dean Hahnemann Medical College.

Evening Session.

Annual address before the Board.

8 P. M. "The Obligation of States and Citizens to Preserve the Health of the People." By Hon. Erastus Brooks, of West New Brighton, N. Y., Member New York State Board of Health.

Thursday, May 13.

Morning Session.

10 A. M. "Drainage and Sewerage of Cities and Towns." By Colonel George E. Waring, Jr., of Newport, R. I.

Discussion by Hugh Hamilton, M. D., of Harrisburg, Pa. Joseph G. Richardson, M. D., Professor of Hygiene, University of Pennsylvania.

11 A. M. "The Relations which the Topography of Harrisburg, Pa., bear to its Drainage and Sewerage."—Illustrated by maps and charts. By Hugh Hamilton, M. D., of Harrisburg, Pa.

11.45 A. M. "The Majesty of Law in Sanitation." By Rev. J. Andrew Harris, D. D., of Chestnut Hill, Pa.

12.15 P. M. "The Prevention of the Spread of Scarlet Fever." By W. W. Vinnedge, M. D., of Lafayette, Indiana.

12.30 P. M. "Means of Elevating the Standard of Supplies." By Mr. H. Wharton Amerling, of Philadelphia.

12.45 P. M. "The Adulteration of Candy." By E. A. Heintz, editor *Confectioner's Journal*, Philadelphia.

Afternoon Session.

2 P. M. "Heredity and other Peculiarities affecting Health and Longevity." By C. W. Chancellor, M. D., of Baltimore, Md., Secretary State Board of Health of Maryland.

Discussion by A. J. B. Jenner, A. M., M. D., of Detroit, Michigan. J. G. Richardson, M. D., Professor of Hygiene, University of Pennsylvania.

2.45 P. M. "The Duties of Sanitary Authorities in Reference to the General Use of Alcohol." By Prof. Henry Leffmann, M. D., of Philadelphia.

3 P. M. "Hygiene of Old Age." By Prof. H. C. Wood, M. D., of Philadelphia.

Discussion by Lawrence Turnbull, M. D., of Philadelphia.

3.30 P. M. "The Influence of Over-work in the Production of Nervous Diseases and Insanity." By Prof. C. K. Mills, M. D., of Philadelphia.

4 P. M. "Defective Vision in School Children." By Prof. P. D. Keyser, M D., of Philadelphia.

Discussion by A. J. B. Jenner, A. M., M. D., of Detroit, Michigan.

4.30 P. M. "Municipal Sanitation." By H. B. Horlbeck, M. D., of South Carolina, Health Officer of Charleston.

Discussion by Morton Prince, M. D., of Boston, Mass.

5 P. M. "Vaccination." By Dr. Wm. M. Welch, Physician-in-Charge Municipal Hospital, Philadelphia.

Discussion by A. J. B. Jenner, A. M., M. D., of Detroit, Michigan.

Evening Session.

8 P. M. "Water Supplies of Town and Cities." By Charles Smart, M. D., Major and Surgeon, U. S. A.

FRIDAY, MAY 14.

Morning Session.

10 A. M. "Artificial Feeding of Infants." By John M. Keating, M. D., of Philadelphia.

Discussion by Prof. Albert R. Leeds, M. D., of Stevens' Institute of Technology, Hoboken, N. J. A. J. B. Jenner, A. M., M. D., of Detroit, Michigan.

10.45 A. M. "The Water Supply of Philadelphia." By J. Cheston Morris, M. D., of Philadelphia.

Discussion by Prof. Albert R. Leeds, M. D. Charles W. Dulles, M. D., of Philadelphia.

11.45 A. M. "Mistakes in School Architecture." By J. H. McClelland, M. D., of Pittsburgh, member State Board of Health of Pennsylvania.

Discussion by Prof. P. D. Keyser, M. D., of Philadelphia.

12.30 P. M. "Disposal of Human Excreta by Fire." By W. S. Ross, M. D., of Madisonville, Kentucky.

Afternoon Session.

2 P. M. "Influence of Diet on Health." By A. K. Hills, M. D., of New York.

2.15 P. M. "The Financial Aspect of Sanitation." By Alfred Ludlow Carroll, M. D., of West New Brighton, New York.

2.30 P. M. "Social Sanitation among the Japanese." By D. R. Simmons, M. D., of Yokohoma, Japan.

3 P. M. "The Sanitary Significance of Sporadic Typhoid Fever." By Pemberton Dudley, M. D., of Philadelphia, Member State Board of Health of Pennsylvania.

3.30 P. M. "The Causation of Pneumonia." By Henry B. Baker, M. D., of Lansing, Michigan, Secretary Michigan State Board of Health.

4 P. M. "Care of Animals in the Propagation of Vaccine." By Prof. W. L. Zuill, M. D., Professor of Comparative Anatomy, Veterinary Department, University of Philadelphia.

The balance of this day's session will be devoted to voluntary remarks.

Among the many distinguished gentlemen who have promised to be present and take part in the discussions, besides those already announced in the programme, we note the following:

Charles Mitchell, M. D., Health Officer of Nashville, Tennessee.

John B. Hamilton, M. D., Surgeon General United States Marine Hospital Service.

Hon. John F. Hartranft.

Colonel William Ludlow.

Adjutant General P. N. Guthrie.

W. C. Cook, M. D., County Health Officer, Nashville, Tennessee.

Edward W. Germer, M. D., Erie, Pennsylvania, President State Board of Health of Pennsylvania.

Mr. Samuel L. Smedley, Chief Engineer and Surveyor of Philadelphia.

W. J. McClure, M. D., Health Officer, York, Pennsylvania.

George Homan, M. D., } Members Missouri State Board of Health.
Albert Merrill, M. D., }

W. F. Hyer, M. D., Member Mississippi State Board of Health.

Dr. David Engelman, Easton, Pennsylvania, Member Pennsylvania State Board of Health.

G. H. Wilson, M. D., Member Connecticutt State Board of Health.

The headquarters of the Convention will be at the St. George hotel, where special rates have been made for those attending the Convention.

PEMBERTON DUDLEY, M. D.,
BENJAMIN LEE, M. D.,
JOSEPH F. EDWARDS, M. D.,
Committee of Arrangements.

JOSEPH F. EDWARDS, M. D.,
Chairman Com. of Arrangements, 224 S. 16th, St., Phila., Pa.
EDWARD W. GERMER, M. D.,
Pres. State Board of Health of Pennsylvania.

III. PAPERS READ BEFORE THE SANITARY CONVENTION IN PHILADELPHIA, MAY 12, 13 AND 14, 1886.

1. Heredity and Other Peculiarities Affecting Health and Longevity.

By C. W. CHANCELLOR, M. D., *Secretary of the Maryland State Board of Health.*

Mr. President and Gentlemen of the Convention: If health is such a blessing—the very source of all pleasure—it may be worth the pains to discover the regions where it grows, the springs that feed it, the customs and methods by which it is best cultivated and preserved.

Every aged person is apt to think his or her own peculiar habits the cause of long life; for example, a certain lady who lived to be 90 years of age, ascribed her preservation to a practice she had of shutting herself up in the house from the first of October until the first of April; while a pauper, who lived to be 115 years old, ascribed her great age to her absolute indifference to all weathers. We find one old gentleman at 96 years of age ascribing his robust health and green old age to the fact that he limited himself to one simple dish at dinner, and had all his life eschewed intoxicating liquors; while his older brother, on "the shady side" of one hundred, but still enjoying perfect health, declares that he is in the habit of making his dinner on roast-pig and cracklings, fat bacon and cabbage, baked beans and cucumbers, currant tarts and cheese, with four pints of small beer and a pint of "Jersey lightning" as his daily beverage.

There is no circumstance, perhaps, which seems more surely to promise health and long life to any individual, than his being descended from healthy and long-lived ancestors. This doctrine is of great antiquity; for both Hippocrates and the elder Pliny have remarked that, as a general rule, healthy parents will have healthy children. It is a well-established fact, moreover, that children have a predisposition to suffer from the maladies of their parents; and, on the same principle, they are entitled to enjoy the perfections of those to whom they owe their birth.

There are some melancholy instances where the vices and diseases of the parents have become the bane of their posterity; for there can be no doubt that parents not only communicate their peculiarities to their children, but also a predisposition to certain diseases. Huxley states that "no structural modification is so slight, and no functional peculiarity is so insignificant in either parent, that it may not make its appearance in the offspring."*

Darwin is still more explicit on this point. He says: "Ovules and the male element, before they become united, have, like buds, an independent existence. *Both have* the power of transmitting *every single character* possessed by the parent form. We see this clearly when hybrids are paired *inter se*, for the characters of either grandparent then reappear perfectly or by segments, in the progeny."†

Some authors hold that the offspring is actually a dual personality, made up of a complete organization or individuality inherited from the father, and another equally complete inherited from the mother. Thus, says Huxley: "It is conceivable, and, indeed, *probable*, that every part of the adult contains molecules derived from the male and female parents; and that, regarded as a mass of molecules, the entire organism may be compared to a web, of which the warp is derived from the female and the woof from the male. And each of these may constitute an individuality in the same sense, as the whole organism is one individual, although the matter of the organism has been continually changing."‡

Many suppose that the hereditary predisposition may be obliterated by suitable measures; that whatever promotes the general health of the individual will tend to remove any weakness, or facility of derangement, depending on original corporeal structure. This doctrine is perhaps well founded, if we admit the theory of "variations," which is a feature in heredity equal in importance with that of transmission from parent to child.

Professor Brooks says: "We know that each characteristic has been gradually acquired through a long series of modifications; that all the wonderful adaptations which fit animals to their surroundings,

*Anatomy of Invertebrate Animals, p. 30.

† Variations of Animals and Plants. Vol. ii., p. 431.

‡ See Encyclopedia Britannica, Art. Evolution.

and meet their peculiar needs, have been evolved, step by step, by the natural selection of the fittest congenital *variations*. Each race characteristic has at one time been a new variation, and the process of modification is still going on and perfecting the harmony between the structure of each organism and its needs. No theory of heredity has any value unless it explains the way in which new features may become hereditary, continually make their appearance as congenital variations, at the same time that it accounts for the way in which established peculiarities are handed down from generation to generation.

"The problem," continues Professor Brooks, "is two sided; what is now hereditary was at one time variation, and each new variation may soon be hereditary. Heredity and variation are opposite aspects of the same thing, and an explanation must be examined and tested on the one side as well as on the other, before it can be accepted.

"It is plain that as soon as one part has varied in any direction, the harmonious adjustment of related parts will be disturbed, and that they too must vary correspondingly in order to restore the proper tone to the whole"§

Such being the case, it becomes us as sanitarians and physicians, to study this law of variation, which may furnish an explanation of the hidden causes of many diseases, and their connection with hereditary transmission.

It has frequently happened that where an individual has been distinguished for longevity, one or the other of his ancestors has been long lived; but this rule is far from being universal, and we are not to suppose that long-lived parents always secure long life to their offspring. Statistics will serve to show, in a measure, to what extent the rule may be relied upon. The number of individuals, beyond eighty years of age, mentioned in the reports of several London hospitals, as inmates, amounts to no fewer than 598; of these 303 affirmed that they were descended from long-lived ancestors, but the remaining 295 either knew nothing at all about their ancestors, or declared that they had not been remarkable for long life. From this it will appear that old age is in many instances a result of other circumstances, which may be combined with or altogether independent of long life in the parents.

That long lived parents should have children likely to live long is not to be wondered at. The same general rule applies to vegetable as to animal life. Although the seed of every tree or plant will produce a tree or plant of the same sort, and possessed of equal beauty and duration, yet at least two points must be attended to: 1st. That the seed must be sound and wholesome; and 2d. That it be deposited in a proper soil.

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§ Law of Heredity, p. 281.

Though some authorities are inclined to deny the existence of hereditary diseases, they nevertheless acknowledge that a *predisposition* to a particular disease may exist; and daily experience must convince every one of common observation that there are many maladies which children *inherit* a "predisposition" to from their parents, even where endeavors have not been wanting to check that tendency. Again there are certain diseases, as for example the gout, which will afflict the father, but spare the son, only to reappear in the third generation.

Lord Bacon observes that "the immediate condition of the parents, as well of the father as of the mother, will affect their offspring;" but Sir Thomas Brown, while admitting that a certain *texture of stamina* is favorable to certain forms of disease, rejects the idea of hereditary taints. Other authors believe that the parent must be afflicted with the disease before the child is born, or, at least, that there must have been a previous taint in the constitution of the parent, in order to transmit the disease; thus, if no gouty taint existed in the family, and the parent was not afflicted by the disease *until he had reached forty years of age*, all his children born previous to that period would be exempt from it, whilst all those born afterwards could hardly escape a disposition to the malady.

In all animals much seems to depend upon the healthy state of the mother, in fixing the vital status of the child. It is quite well confirmed by experience that the state of the child's health and constitution depends much more upon the condition of the mother than on that of the father. Lord Bacon states, as a general proposition, that animals which partake more of the nature of their mother than their father are the longest lived, and he remarks that "among men as among other animals, those who resemble the mothers most are the longest lived."*

It has been asserted that the physical organization or outward shape, at least of a male child, depends more upon the father than upon the mother, but that the talents and structure of the mind are derived from the mother. In regard to the second proposition, it is alleged that a clever woman seldom has children remarkable for mental deficiency, and that the abilities of many families may be traced to one distinguished female who introduced talents into it which have descended, not only to her immediate offspring, but have been transmitted to her remote posterity.

The cases of two of the most distinguished families in England, in point of talent, have been cited in verification of the foregoing theory. The abilities and eloquence of Pitt were believed to have been inherited from his mother, a Miss Innes, of Redhall, in the Highlands of Scotland, and the talents of the family of Dundas, of Arniston, have also been attributed to the marriage of one of their ancestors with a Miss Sinclair. On the other hand, Darwin, in discussing the statement

*Hufeland, vol. ii., p. 123.

of certain authors, that the father influences the external characters and the mother the internal characters, declares emphatically that, "*It is an error to suppose that the male transmits certain characters and the female other characters.*"*

In considering how much the health and stamina of children depend upon the condition of their parents, it may be a question for sanitarians to discuss, "Whether diseased persons should not be prohibited from marrying?" inasmuch as such marriages are likely to produce nothing but disease, deformity, social distress and political mischief.

Buchan, in the eighteenth edition of his Domestic Medicine, justly remarks, that "the unhealthiness of parents must be a fruitful source of disease in their children;" and that "it would be as reasonable to expect a rich crop from a barren soil, as that strong and healthy children should be born of parents whose constitutions have been worn out with intemperance or disease."

A delicate female, brought up within doors, and an utter stranger to exercise and open air, who lives, as it were, on tea and other slops, may bring a child into the world, but it is hardly fit to live. If to the delicacy of the mother we add the often irregular life of the father, we shall have further cause to believe that children who die early are in many instances victims to the shattered constitutions of their parents. A course of vice will spoil the best constitution; and when disease is once contracted and riveted in the habit, it is, in a manner, entailed upon posterity.

In regard to the question of perfect birth, as connected with health and longevity, it is only necessary to say that the usual period of gestation is nine calendar months, but there is very commonly a difference of one or two weeks. Hippocrates considered perfect birth so essential to a healthful manhood, that in his book *De Septimesti Partu*, he contends that children born in the seventh month seldom live long; but there are many instances recorded to the contrary. James Donald, an old man who resided near Dumbarton, in Scotland, and lived to the age of 100 years, was born, it is said, in the seventh month; and George III, who died in his eighty-second year, is also reported to have been born in the seventh month. It cannot be denied, however, that a uniform and faultless conformation of the whole body tends to promote health and long life, while an imperfect structure, whether it be the result of accident or hereditary predisposition, affords an easy opportunity for the onset of local diseases, which are often extremely prejudicial to the duration of life.

In some constitutions all diseases are mild and gentle, whilst in others they are violent, and are only cured, if at all, with difficulty. One person is liable to catch any contagious disorder, whilst another may, without hazard, enter houses infected with small-pox or other

* Variations of Animals and Plants, vol. ii, p. 431.

contagious maladies. Some individuals seem to have inherited a certain bodily and mental disposition to live long and keep well, whilst in others all the advantages combined—as a salubrious climate, a strict adherence to the best rules of diet, a regular course of recreation, exercise, etc ,—are not sufficient to insure a long or healthy life.

It is said that the great Boërhaave learned the characteristic signs of perfect health from the Dutch slave dealers, who from long practice necessarily became well acquainted with semiotics or the doctrine of signs and symptons. The following are the signs which, according to medical authors, denote a good constitution, and when present in the parents prognosticate long life in the progeny.*

1. A sound stomach and organs of digestion. The stomach has properly been called "*The father of the family*," for if it goes wrong the whole body suffers, and its variations readily become hereditary predispositions.

2. A capacious chest and healthy organs of respiration, breathing being the most necessary of the vital operations. That *phthisis pulmonalis* is transmitted from parent to child is now an admitted fact.

3. A heart not too irritable, the action of which is not increased by every trifling agitation of the mind or action of the body. This variation from a normal condition of the circulatory apparatus may lead to hereditary organic trouble.

4. A good temperament. The best is the sanguine, tempered with a little of the phlegmatic. This produces a serene, cheerful mind, moderate passions, undaunted courage, and that state of mind which is the most fitted for longevity.

5. A strong natural power of restoration and healing, by means of which the losses we daily and hourly sustain are not only repaired, but well repaired.

6. A uniform and faultless conformation of the whole body. An imperfect structure gives an easy opportunity for the advent of local diseases, which may bring on death.

7. No particular weakness of any part. Even where the organization is apparently good and perfect, there may be a concealed enemy in some organ, which may afterwards destroy the whole body.

8. A medium quality in the texture of the organization, strong and durable, but not too rigid. It is proper to bear in mind that strong constitutions sometimes do not last so well as the more feebie, for, in the first place, the strong are tempted to take less care of their health, and in the second place, they often suffer more from the same disease than those who have less energy to contend with it, the vehemence of the disorder, as in fevers and inflammations, being frequently aggravated by the strength of the patient.

Among the various circumstances which tend to promote health

*See Finke's Medical Geography, vol. i, p. 449, also Tissot. Essai sur maladies des Gens du Monde, p. 8.

and longevity, independent of attention to the observance of particular rules, there is none of more real importance than the configuration of the body or the *physique* which the individual receives from nature, for in so delicate a machine as man any material fault in regard to structure must sooner or later be felt. Plausible arguments, however, are not wanting in favor even of deformity. Mr. William Hay, who was a member of Parliament, and himself deformed, thus defends the shape which nature gave him: "It is natural to imagine that if the human frame is warped and disproportionate, it will be lessened in regard to strength and activity, and will be rendered less fit for its different functions; consequently, that deformed persons are not healthy or long lived. But this is a question best determined by facts; and in this case the instances are too few or unobserved to draw a general conclusion from them. Besides, health is more in a person's own power than is commonly imagined, and is more the reward of temperance than the effect of constitution. The celebrated Æsop certainly was not young when he died, and might have lived longer had he not been murdered at Delphi. The Duke of Luxemburg died at 67, the Lord Treasurer Burleigh at 78, Mr. Pope's father at 75, and they were all deformed."*

As a standard of perfection in the human figure, artists commonly divide the height of the body into ten times the height of the face. They likewise divide the face into three equal parts. The first commences at the springing of the hair on the forehead, and terminates at the root of the nose; the nose is the second division, and the third extends from the nose to the end of the chin. The celebrated artists Bartolozzi and Cipriani, however, give more grace to their figures by deviating from these proportions, and giving more length to the body, particularly in females.

Medical men, in their view of the form best calculated for health and longevity, deal more in general description than in minute details. According to Hufeland, who has treated more fully than any other medical author upon this part of the subject, the following is the portrait of a man destined for longevity:

"He has a well-proportioned stature, without being too tall. He is rather of the middle size, and somewhat thick set; his complexion not too florid; his hair approaches rather to the fair than the black; his head is not too large; his shoulders are rather round than flat; his neck is not too long; his belly does not project; his hands are large, but not too deeply cleft; he has a broad, arched chest, a strong voice, and prominent veins; his pulse is slow and regular. In general, there is a complete harmony in all his parts."†

The celebrated Lavater gives the following as the signs, if not the ingredients of long life: "An elevated forehead, sunken eyes, a large

*See *Dodsley's Fugitive Pieces*, 1765.

† Hufeland on Animal Life, vol. 1, p. 231.

nose, somewhat curved, a soft but not overlax skin, a character artful, suspicious, covetous and deceitful; obstinacy and emulation are inseparable from it."‡

In connection with this subject, no better account of the law of heredity can be given than that found in an article by Prof. Brooks, of the John Hopkins University, published in the *Popular Science Monthly* for June and July, 1879, under the title "The Condition of Women from a Zoölogical Point of View," wherein the distinguished author alleges that it is universally, but never absolutely true, that like produces like. "The offspring," he says, "resembles its parents in all fundamental characteristics. The human child, for instance, resembles its parents in the possession of all the characteristics which distinguish living things from those which are not alive, as well as those which distinguish animals from plants. The chemical, physical, and physiological changes which take place in its body and the histological structure of its tissues are like those of its parents, and its various organs are the same in form and function. * * * It also shares with its parents the features or race characteristics of the particular tribe or race to which they belong. If they are Chinese, Indians or negroes, the child belongs to the same race, and manifests all the slight, superficial peculiarities of form, constitution and character by which that race is distinguished. Even the individual peculiarities of the parents, intellectual and moral, as well as physical, are now known to be hereditary. * * * The child is like its parents, but not exactly like them. It is not even a compound of characteristics found in one or the other of them, but has individual characteristics of its own, slight variations, which may not have existed in either parent or in any more remote ancestors. * * * *

"The series of hereditary structures and functions which makes up the life of an organism is constantly being extended by the addition of new features, which, at first mere individual variations, are gradually built into the hereditary life history. In this way newly-acquired peculiarities are gradually pushed further and further from what may be called the growing end of the series, by the addition of newer variations above them. It can also be shown that, from time to time, the peculiarities of the other end of the series, the oldest hereditary features, are crowded out of the life of the organism and dropped, so that an animal which is high in the scale of evolution does not repeat, in its own development, all of the early steps through which its most remote ancestors have passed."

Statistics show that nearly one-half of all the children born die under five years of age, and that a majority of these perish from deficiency of stamina, or inherited ailments, most of which are amenable to measures of prevention. It is surprising to what an extent we may rectify

‡ Hunter's Translation of Lavater, vol. iii, p. 169.

the *tendency to debility*, the inception of disease, *even anterior to birth*, when too often the mischief is unwittingly done by the mother, who produces in her offspring future diseases of body, or some degree of physical deterioration. Few mistakes, for example, are more common among women than that of regarding the very natural process of child-bearing as something seriously debilitating or otherwise abnormal, to be counteracted by change in their habits and mode of life, as the indulgence of various fancies and cravings, the consumption of more and richer food than usual, gratifying the appetite for stimulents, etc. These errors conduce directly to "variations" or "hereditary predispositions," which lead to the early dissolution of the offspring, or they foster those very evils which it was intended to avoid.

A scrofulous, consumptive or otherwise delicate tendency in the child may arise from the occurrence of conception when one or the other, or both, parents are laboring under or recovering from weakness or disease; and as certainly may epilepsy or idiocy in the offspring be traced to the intemperance of one parent or both.

Essential benefits may be conferred upon humanity by such reforms as can be silently effected by sanitary association, having for their golden aim the mitigation of human wretchedness; and what more promising field for those whose merciful mission it is to "go about doing good," than that of inculcating the simple, obvious laws of health, the infringement of which is so often followed by misery, disease and death? The life of man is not only embellished in its course by the advancement of sanitary science, but it is extended and rendered less doubtful.

As man reaches the plenitude of his physical and social development, the population becomes strong, intelligent and manly; while he remains, as it were, in perpetual infancy, whole generations are swept away without being able to profit by the past, or to bring social economy to perfection.

In his lowest state, man had no pleasures but those of sense, and no wants but those of appetite. In the gradual exaltation of human nature, every art contributes its contingent toward the general supply of his physical and mental perfection. Whatever abstracts the thoughts from sensual gratifications—whatever tends to improve health and prolong life—must advance, in some measure, not only our happiness, but the dignity of human nature. We are continually laboring to advance, step by step, through successive gradations of excellence towards perfection, which is dimly seen at a great distance, and which we must always follow, because we never can attain; but the pursuit rewards itself. One truth teaches another, and our store is always increasing, though nature can never be exhausted.

II. The Artificial Feeding of Infants.

By JOHN M. KEATING, M. D.,

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The honor that was conferred upon me by the request to present a paper to this meeting, carried with it a responsibility which, I freely confess, the more I look into the subject, by no means lessens. The large audience which I address, gathered as they are from all portions of the Union, have come here to carry away to their constituents certain facts which I have endeavored to deduct from the mass of published material, and which are to be used for no less a purpose than the attempt at saving life.

Were my hearers alone members of the medical profession, it would not be necessary for me to explain the reason why so much stress is laid upon a subject which appears so simple, nor would I be required to throw the veil over the various apparent discrepancies and contradictory statements that pervade the literature of my subject. They know full well that thousands yearly die in early infancy from disease which is the offshoot of ignorance and carelessness.

They also know that science is not progressive by rapid strides in lines that are straight, but that its true progress is slow, tentative; its path marked by discussions; ofttimes it seems to retrograde, and then, discovering a new way, it abandons the old one, but in the long run reaches the goal.

Men's ambition for fame and desire for riches seem for a time to cover the track of progressive science, to anticipate it, to lead it on, but the spark burns brightly beneath.

To my non-medical hearers I will say that, in answer to your question, Why is it that so many apparent differences exist regarding the bringing up of infants? I reply that it is not because science has ceased to advance in this direction, but because we are situated in its pathway, and not at its goal.

We are learning from the chemist the composition of human milk —of nature's food; from the physiologist the composition of the secretions; from the anatomist the laws of growth and development of the human body.

These studies are intricate; they require frequent corrections, and, as a consequence, the sum total is affected by discrepancies existing in the figures of the component parts.

I believe that it is better for us to-day to avoid questions that are still *sub judice*, and confine ourselves as closely as possible to such facts as will warrant our basing some conclusions upon them.

Let me for a moment give you a few statistics to show you the importance of our subject. We are entering the season of the year during which intestinal disorders among infants give us a mortality that is appalling. I believe that if you will carefully study the matter which I will present to you, and disseminate these suggestions, which are based not alone upon my experience, but upon that of others, you will be benefactors—more than that, you will save life.

The tables I present, compiled from the census reports of 1880, prove several interesting points. One is the enormous increase of mortality during the heated season; the other, the fact that the much-dreaded *second* summer has a low comparative death rate. Thus, in New York and Pennsylvania, for 1880, 35,377 children died within the *first* year (inclusive), and but 6,031 between the first and second years, and 4,139 between the second and third years.

As we know that disorders of the intestinal tract cause a very large proportion of these deaths, and that the attempt at artificial feeding is usually productive of unfortunate results, too much attention cannot be paid to the subject. Disraeli, in one of his best novels, tell us that "mother's milk makes the true-born Englishman." Mother's milk is undoubtedly the proper food for the new-born infant, and though I believe we have reached a degree of accuracy in the matter of food preparations and knowledge of the infant requirements that would in a great degree show itself in a diminished death rate, could we secure the thorough coöperation of intelligent nurses and mothers.

I cannot but regret the tendency which the imperative dictates of fashion bring about, to the development of feeble women who are ill fitted to bear the burdens of maternity, or to nourish the children they bear. Wet-nursing and bottle-feeding should be discouraged except in cases of absolute necessity.

But let us suppose that for some excellent reason mother's milk is not obtainable and the wet nurse question has been decided adversely, upon what and how should an infant be fed?

We will at once agree that *milk* should form the basis of an infant's diet.

It is composed of five different classes of material which are essential to nutrition; water, casein and albuminoids, salts which go to the formation of bone and secretions, fats and sugar, or the carbo-hydrates, which latter two have much the same action.

The child gets the same food as the adult, but it gets it in a condition more easily digested and more readily absorbed. More than 87 parts in a hundred of its food is water, but when the chemist tells us that 70 per cent. of the human body-weight is water, its importance is readily recognized. Then we have the nitrogenous group represented by the casein, the muscle forming; and then the fats and sugar which maintain the animal heat, and the salts for bone and secretion. Digestion is a solution by hydration, so that the elements acted upon

may pass readily through the wall of the alimentary canal, after which they are dehydrated.

You see that digestion is not merely a process of disintegration; certain secretions are requisite to bring about the chemical changes required—what are these secretions? First we have that from the salivary glands; the saliva secreted by a child under six months is at a minimum, very little is required, simply enough to lubricate, but I may say that in a series of experiments, I have recorded a child of seven days who secreted saliva which possessed sufficient diastase to convert the boiled starch used into grape sugar. This readily accounts for those infants who fatten on corn starch, much to the surprise of the family medical attendant.

As the child grows and teething begins, quite a large amount of saliva is secreted, and undoubtedly the activity of this secretion forms a prominent part in its digestive process; in other words a child that slobbers as a rule has little digestive disturbance.

From birth the gastric juice takes a prominent part. By it the curd is precipitated and turned into peptones or albuminose. All albuminous matter is so converted, and a burden by no means light is placed upon the liver, an organ more prominent in infancy than in adult life, to de-hydrate this material which now courses through it, to maintain its glycogenic function, and to throw off those refuse matters that are discharged into it.

The precipitation by gastric juice of the casein presents some curious features, indeed, this matter is of fundamental importance in our studies. Woman's milk is alkaline, it is watery, its curd is precipitated in soft flakes. Cow's milk is slightly acid; its curd forms in firm, hard masses of cheesy consistence. Brush, in 1879, told us that the curd in all cud-chewing animals, of which the cow represents the class, was thrown down in masses so as to be readily regurgitated by the calf for the purpose of trituration. In the non-cud-chewers the reverse is the rule. There may be other peculiarities of the curd, chemical differences, but these have not as yet been determined.

The secretion of the pancreas is the next and the last of importance. It is composed principally of two materials, in fact a third may be added, the curdling principle; these will act in an alkaline or faintly acid solution; the first a material analogous to the pepsin of gastric juice which converts casein or other albuminous matters into peptones, such substances that have escaped the action of the gastric juice, and a *diastase* like that of the saliva which converts starchy matters and cane sugar into dextrine or grape sugar.

To the infant the gastric juice is the most important of its secretions, only such food as contains albuminous matter with soluble carbohydrates as glucose and oil in emulsion should be given—such, indeed, is milk.

We have then two matters to consider in the artificial feeding of infants—and I shall limit myself to those within the first year—one, the preparation of a food containing the elements of mother's milk, in a combination as much like it as possible; and the other, no less important, the elaboration of those secretions which digest it—an equal balance must be maintained between the two. I will confine myself to the questions of the former. With all due respect for the opinions of those who have endeavored to give us an accurate analysis of woman's milk, I feel that in basing upon it any preparation that would be invariably scientifically correct, we would fail in the very line which nature herself has clearly drawn for us, that is by not giving sufficient latitude for the different organizations of different individuals.

Granting that the human milk is the proper basis to start upon, how much food does a child require in 24 hours? So much depends on the infant; if the bowels are normal, and there is no evidence of indigestion, the breath sweet and the child seems desirous for more after it has finished its bottle, there is no reason why it should not be satisfied. A child of a month should be nursed about ten times in 24 hours, every two hours during the day and three hours during the night; at each nursing it should take from two to three ounces of milk. At the age of about three months it will probably nurse only about eight times, taking about six ounces at each feeding; at the end of about six months it will take about eight ounces. I believe that this would represent about the amount of breast milk that such a child would receive.

Having now stated the amount of food that a child requires, let us dwell at some length on the character of its diet and its preparation. In order that the directions may be carried out thoroughly they should be made as simple as possible. We all acknowledge that cow's milk has the following advantages: it serves as the basis for the preparation of a milk resembling that of the human mother; it possesses all the ingredients that are necessary for nutrition; it is easy to obtain. Its disadvantages are, that the relative proportion existing between its different constituents is not that found in mother's milk, it possesses a form of casein which forms hard curds, this casein exists in larger amounts, at least twice or more than in human milk.

It is impossible for the child to nurse directly from the cow, and therefore a certain time must elapse during which the milk undergoes possibly some alteration from exposure to the air, is liable to be tainted with the germs which produce decomposition, and this indeed is the greatest objection to its use in our large cities. It is acid, though precisely what affect this has, or what it is due to is not exactly clear to my mind.

But these objections can be readily obviated by the following means:

the milk from an ordinary dairy should be obtained as fresh as possible, mix together a half of a pint of this milk and a half of a pint of pure water, and to this should be added about two hundred grains or two heaping teaspoonfuls of milk sugar, with four grains of bicarbonate of soda; it should then be brought to a boil, after which two tablespoonfuls of cream should be stirred in, and it is ready for use, to be given by bottle or drinking cup, at about the body temperature.

We have here a mixture, which, according to Leeds, closely resembles mother's milk; we have also a preparation which has been freed by boiling from the objection stated above, in cow's milk, that due to a tendency to fermentation, and indeed the milk is rendered more digestible by it.

In new-born children or those a month or two old, we may diminish the amount of casein and increase the amount of sugar by the following means: Take one ounce of ordinary milk, three ounces of water; add one ounce of ordinary cream and about a level teaspoonful and half (80 grs) of milk sugar. Indeed, it is better to run the risk of making a mixture with too little casein than with too much, gradually increasing strength of the milk by diminishing the water, as the child grows older; but it should also be borne in mind that as we increase the water we should also increase the carbo-hydrates, by adding either sugar of milk or some of the malted foods. Sugar of milk rapidly sours and turns to lactic acid when dissolved in water; and indeed, I believe that on this account there is little choice between it and *cane* sugar. In a case of diarrhœa, I would leave out *sugar* altogether. My own experience teaches me that with care cane sugar has not the disadvantages in most cases, in winter, that some fear.

This brings us to the subject of condensed milk; a reliable brand of Borden's or Canfield's has the following advantages: When diluted with five to ten parts of water it represents mother's milk pretty closely, with the exception that there is less cream, but to a pint of this mixture four tablespoonfuls can readily be added. The evaporation of the milk in its preparation has destroyed its tendency to fermentation to a great extent, this most certainly is a great advantage; it will coagulate in flakes, and does not require the addition of any sugar, as by analysis it is shown that when the mixture is thus prepared, the amount of sugar it contains is about equal to mother's milk. It can be universally obtained, and is useful on that score; its disadvantage in many instances is due to the cane sugar, and some object to it on the ground that it is supposed in many cases to lead to rickets.

My own experience does not bear this out, though certainly if I were to find that a child fed on condensed milk should show undue acidity, either in its stools or its breath, due to the presence of lactic acid, I would at once change its diet. This, careful watching should avoid.

In summer weather the presence of cane sugar, which is a decided laxative, is objectionable, and herein exist the great difficulty of the proper selection of a food for that season.

In order to counteract any tendency to rickets, I usually incorporate in the milk some lime—either lime water, or still better, I think, the lacto-phosphate and carbonate of lime; indeed I would establish this as a rule in the preparation of all milk foods that require the addition of sugar. In my opinion, lime water falls far short of reaching the good claimed for it. When we come to consider that only *eleven* grains of lime are found in the pint, two tablespoonfuls will contain about one-third of a grain, too small an amount by far to be of any service whatever in either neutralizing any undue acidity, or of any service in supplying lime to the tissues; it will need equal parts to accomplish the former; the probability is that it is the dilution of the milk which is beneficial in cases where it is thus used.

I have made some very interesting experiments in this line with Mr. Louis Genois, the result of which is as follows: To a half of an ounce of ordinary milk, eight drops of dilute muriatic acid were added, and a curd was thrown down irregular and lumpy. The same milk was taken, and to half an ounce a half grain of lacto-phosphate of lime was added, and the same acid used; the precipitate was smooth, fine, and in fact creamy. The solubility of this preparation of lime, its action on the curd, and its value in counteracting the great tendency to rickets, which I believe exists in all hand-fed children, gives the matter great importance.

For this reason I have had made for me some compressed tablets, each containing a certain proportion of sugar of milk, lime in a soluable form and carbonate of lime, which will, with a small amount of soda, neutralize any undue acidity of the milk. A certain quantity of water is taken, brought to the boiling point, and to this is added the needed amount of milk, say an equal part, in which has been dissolved two or more tablets, and to this is added the necessary amount of cream, and given to the infant in nursing-bottle or by spoon, at the required temperature. Certainly the most stupid mother cannot fail to follow directions so easy. I may say here that this food would be most valuable for nursing women; the loss of teeth, so common during the child-bearing period, is due to a want of lime supply. Nursing mothers should take lime for themselves and for their milk.*

Let us study for a moment the question of the "fresh evaporated milk," served daily in some cities by the Canfield Company, and which, I think, offers for the future the best field for infant feeding, in those cities where it is daily supplied, especially in summer time.

*These tablets are prepared by J. J. Ottinger, Twentieth and Spruce streets, Philadelphia.

The following is its analysis, as given by Prof. Chandler, of New York:*

Water, 52.74 +
Butter, 13.70 +
Casein, 15.04 +
Sugar, 15.80 +
Salts, 2.71 +

If we add seven (7) parts of water previously boiled or filtered, we have a mixture of which the following will represent the analysis:

Water, 94.8
Butter, 1.72
Casein, 1.88
Sugar, 1.98
Salts, .34

Then, taking an analysis of mother's milk:

Water,	87.16
Fat,	4.28
Casein,	1.04
Sugar,	7.4
Ash,	.1

We find that it will be necessary to add to the half pint of the above mixture of evaporated milk, two (2) tablepoonsfuls of cream and two (2) heaping teaspoonfuls of sugar of milk. This will be equal to cow's milk, with about the same percentage of casein as mother's milk. The absence of cane sugar in this preparation renders it most valuable in summer in our large cities when diarrhœa is prevalent. Indeed, in such cases half of an ounce of this milk in a graduated glass with four ounces of water, previously boiled and filtered, given at the temperature of the body, about 99°, without adding cream or sugar, would in many cases be a most suitable diet. If the bowels are loose, lime water could be used. Unquestionably disorders of the intestinal tract are produced by *fermentation* and also by *mechanical irritation* of undigested curds, and this is often due to not alone the method of preparing the food, but also to the deficient supply of the gastric juices. If a large supply of gastric juice could be encouraged, both of these causes would cease to exist, as the acid mixture is anti-putrefactive as well as digestive. Indeed, the acid treatment of summer diarrhœa is an admirable and recognised one, but the limited

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*1 quart of water weighs 2.082 pounds.

1 quart of milk (sp. gr. 1.035) weighs 2.149 pounds.

430 quarts fresh milk=924 pounds.

Deduct 330 quarts of water, removed by evaporation=68.7 pounds.

We have 100 quarts condensed (evaporated milk)=237 pounds.

Now, 430 quarts (926 pounds) fresh milk at $12\frac{55}{100}$ per cent. solids contains 116 pounds solids; 100 quarts of condensed milk (evaporated) (237 pounds) at $46\frac{46}{100}$ per cent. solids contains 110 pounds solids. C. F. CHANDLER.

Report of Commissioners Public Charities, New York, 1871, p. 216.

amount of pepsin and hydrochloric acid that we can administer as a corrective is in many cases insufficient. On this account we are obliged to use some means so as to prepare the milk and destroy its ferments, and to diminish its casein, or so affect it as to allow precipitation in fine masses. The former is readily accomplished by boiling, or by subjecting the milk to heated steam, the latter by several means now in vogue.

The *first*, by rendering the milk alkaline, which retards in a measure the coagulating property of the gastric juice.

The *second*, by diluting the milk with water, which diminishes the percentage of casein.

The *third*, by thoroughly incorporating with it some material, such as gelatine, or a small amount of starchy matter, such as oatmeal water, that will intimately incorporate itself in the casein as it falls, and thus allow the gastric juice to completely attack it; and *fourthly*, to partially predigest the casein, peptonize it as it is called, before it enters the stomach.

We have in addition to these, various other preparations, which are sometimes added to the milk to render it more nutritious, for example, soluble carbo-hydrates, as dextrine, glucose, or substances rich in albuminous matters. This in fact covers the whole ground of the various preparations used in the bottle feeding of infants, and you will thus see that they all have some scientific basis to work upon, and their choice questions of expediency and reliability, which should be studied in connection with each particular case.

Let us study these matters *seriatim*. The experiments of Richmann, and indeed our own experience, show that boiled milk is more digestible than raw. For all city children under a year, and for those older who are passing through the heated term, with whatever form of diet in use having milk as a basis, I would certainly advise that the milk be brought to a boil, or at least thoroughly scalded. Of course, if condensed or recently evaporated milk be used, this is not necessary.

Boiling has another great advantage; it is germ-destroying, and possibly milk contaminated by the contagium of scarlatina, typhoid fever, or even tuberculosis, may be rendered harmless thereby. Let us now take up in turn the *four* divisions of our subject:

1. Cow's milk can readily be rendered alkaline by the addition of lime water in large amounts, soda or potash, and the curd affected thereby. I think the importance of alkalinity is somewhat over-rated, that is, the tendency seems to be to put too much soda in the milk; all that is required is to make it neutral, even for peptonizing purposes.

2. Dilution with water, which should always be previously filtered, to the amount of once or twice its bulk, will so affect the percentage of casein in cow's milk as to bring it to that of the woman, and also

will control the precipitation of the curd, even should the milk remain slightly acid. But this will also reduce the amount of cream and sugar; these must be added.

The question of the digestion of fat needs but a few words. It is greatest in demand at the time when animal heat is the most required, that is during the winter months, the fats and soluble carbo hydrates when supplied in excess are stored for future use; their excess in hot seasons is productive of intestinal disorders. In such cases a change to albuminous water, made by dissolving the white of egg in water makes a nutritious diet and is a valuable change. The oils when stored away give a condition of body which is firm and elastic to the touch, and when this reserve is called upon the emaciation is gradual On the contrary, when the storage takes place from excess of glucose, the fat is not *staying* and its disappearance is sudden. This is well seen in children fattened on condensed milk to which no cream has been added. It is admirably described by Dr. Weir Mitchell in his book.

Lessen then the amount of cream and sugar for the summer season, increase the nitrogenous elements, and render it as readily digestible as possible.

3. There are certain materials which require other juices than the gastric secretions to digest them, and which mingling with the curd allow the gastric juice to precipitate it slowly and thoroughly attack it. These are the cereals. The starchy granules must be thoroughly broken up by boiling or by dry heat, so that either the saliva or the secretion of the pancreas can change the insoluble starch into soluble grape sugar. The infant secretes but little saliva and probably but little of the pancreatic diastase; on this account but a small amount of starchy food should be given it. The milk can be diluted with its bulk of water, which can be previously thoroughly boiled with either ground barley, oat-meal or baked flour, in the proportion of a desert-spoonful to the pint, the milk poured in while the water is boiling, the whole boiled together for a moment and then strained. This can be sweetened, a small amount of cream added, and it forms an excellent food for a child after its fourth month; earlier than that I would prefer the plain milk diet.

The starch should always be placed in a position so as to readily facilitate its conversion into grape sugar, which can be done either by heat or by malting.

Fothergill tells us "By heat the cook cracks the starch granule so that the solvent diastase can readily act upon it. So far, so good; but heat does something more. It has an actual solvent action, and heat will, if sufficient, cause conversion of starch into dextrine. A thoroughly well baked flour if subjected to the iodine test under a microscope will readily show this.

"When a large quantity of raw unconverted starch enters the

stomach it is a burden to that viscus. The gastric juice has no effect upon starch, and the starch granules merely embarrass the action of the stomach until they find their way out of it by the pyloric ring.

"The advantage of the numerous prepared foods—whether babies' foods or invalids' foods—which are all more or less compounds of starch which has been, to a certain extent, predigested either by baking or the malting process, lies in their ready digestibility. A touch of saliva is enough to complete the conversion of such carbo-hydrates, and the soluble matters pass out of the alimentary canal, and the stomach is not burdened with a weight of undigested starch impeding its work.

"Starch granules which have escaped the saliva interfere with the solvent action of the gastric juice on albuminoids."

4. The casein can be previously partially digested by adding to the milk the pancreatic secretion, that which is analogous to the pepsine of the gastric juice, but which is deprived of its curdling element, and which acts in an alkaline or faintly acid medium.

The peptonizing process, or that of converting casein into peptones, can be arrested by boiling the milk just before it assumes a bitter taste, which completely digested material of this sort has.

The value of Fairchild's extract of pancreas in its relation to artificial feeding cannot be overestimated; the milk should be made very slightly alkaline by a small amount of soda. I think too much soda is usually recommended for infant use.

The peptogenic milk powder contains a certain proportion of extract of pancreas, sugar of milk, soda and salts, as suggested by Professor Leeds, and when used with cow's milk and cream forms a combination like mother's milk with the curd partially digested.

I sincerely trust that I have succeeded in convincing you so far that the question involved in the diet of an infant within its first year is simple enough. It is not by making these matters complex that we will accomplish our purpose—not by surrounding them with the impenetrable network of scientific analyses. Our *sums* should be done in private in the laboratory. Our instructions should be made so simple that every mother or nurse can carry them out. But let me for a moment bring before you a tangled mass of material which we will endeavor to unravel; for I know much confusion exists in the lay mind in regard to it—that of the preparations used in the artificial feeding of infants—*baby foods*. We can consider them under three headings.

The *first*, the milk foods. I have already spoken of condensed milk, and need dwell no further upon it. Nestlés food, which contains condensed milk, dried, with starch and glucose, is largely used. Its composition, according to Stutzer of Bonn, the analysis of which I attach to this paper, would lead me to recommend it only after the child has reached the fourth or sixth month. Carnrick's soluble food is also

valuable on account of its large amount of albuminoids and fats; it also contains milk which has been peptonized. The amount of starch which is shown in the analysis would lead me to recommend its most extensive use after the fourth or sixth month. Containing, as it does, a relatively large quantity of bone forming material (lime, phosphoric acid), it should stand very high as a food, and, indeed, in many cases might be used by very young infants. There are many other foods under this heading, but I will be obliged to refer you to the article on diet in J. Lewis Smith's book, page 58, 6th edition.

The *second* division comprises what are known as Liebig's foods. By this is understood dried preparations composed of grain, which has with it a certain amount of diastase or malt, and part of which has been converted into dextrine or grape sugar. They also contain albuminoids, which, as you know, are the nitrogenous elements, like the curd of milk. Some of these foods contain, to a certain extent, an amount of starch, which in many of them is in a condition readily to be converted by heat and moisture into a soluble grape sugar. Their efficiency and digestibility depend on the amount of glucose and albuminoids which they contain.

As a rule, they should be used with milk after the child has reached its fourth month, though at a very much earlier period in many cases they have been found very useful.

From the analysis of Stutzer, the most recent made, I would place Mellin's and Horlick's food in advance of the others, on account of the large amount of the soluble hydro-carbons and albuminoids, and an exceedingly small amount of free starch. Of course, these foods should be used in small quantities, and always with milk; at first they should be looked upon as so much sugar, only possessing, in addition to the grape sugar, certain very nutritious materials (albuminoids), which ordinary glucose has not, and also the bone forming materials which we find in the cereals.

We now come to the *third* division, the farinaceous group, known as "wheat foods," including Imperial Granum and Ridge's food. They, in fact, are nothing more than starch which has been subjected to a more or less careful heating process, and can be used for children after four months, as I have suggested in a former part of this paper, when speaking of starches to aid the digestibility of casein. The starch granule in many of them has been thoroughly broken up by a careful heating process, and thus reached an advanced point towards its digestion in such foods as Hubbel's and Blair's wheat food.

I beg of you then to bear in mind that milk alone, with more or less alteration in the percentage of its ingredients, should serve as the food for a babe for at least two months.

The bringing up of children by the bottle is by no means as difficult as many think. All that is required is a thorough understanding of the object in view, by the doctor, nurse or mother, and thorough clean-

liness and regularity, and an intelligent carrying out of matters that routine will soon render very simple. *But bear in mind that there can be no cast-iron rule by which all children are fed. Each child differs from another, and it is he who makes a study of each special case who will be most successful in accomplishing the purpose desired.*

1504 *Walnut street.*

BY DR. STUTZER, OF BONN, GERMANY.

	Nestle's Food.	Carnrick's Soluble Food.	Mellin's Food.	Well's, Richardson & Co.'s Lactated Food.	Horlick's Food.	Dr. Ridge's Patent Food.
Fat,	4.66	5.00	0.50	2.19	0 60	1.27
Protein substances (albuminoids),	11.46	18 22	8.34	9.05	11.30	8.76
Soluble hydrocarbons (sugars, dextrin, etc.),	41.22	26.87	60.89	25.52	65.92	1.79
Insoluble hydrocarbons (starch, etc.),	35.47	40.87	18.40	52.92	13.12	78.66
Cellulose,	0.10	.....	0.58	1.54	0.55	0.73
Water,	5.34	6.14	7.76	6.52	5.75	8.31
Salts and inorganic constituents,	1.75	2.99	3.53	2.26	2.76	0.48
Amount of nitrogen in protein substances,	1.833	2.915	1.335	1.448	1.809	1.403
Amount of protein substances readily digestible,	11.09	16.45	7.38	8.35	10.85	7.97
Proportion of nitrogenous alimentary substances (Protein = 1),	1:7.7	1:4.4	1:9.6	1:9.2	1:7.1	1:9.3
The inorganic constituents contain Lime,	0.390	0.645	0.155	0.390	0.060	0.060
The inorganic constituents contain Phosphoric acid,	0.630	0.874	0.583	0.688	0.421	0.260

From *Pharmaceut*, Central Halle, Berlin, 1886, No. 8; *Pharmac. Rundschau* (New York), 1886, page 89; *Buffalo Med. and Surg. Journal*, May, 1886, page 472.

DEATHS IN PENNSYLVANIA AND NEW YORK FOR YEAR 1880.

		Under one year.	One year.	Two years.	Three years.	Four years.	Total under five years.
Pennsylvania,	Male,	7,694	2,274	1,510	1,034	782	13,294
	Female,	6,048	1,920	1,310	918	780	10,976
New York,	Male,	11,335	3,139	1,719	1,113	821	18,127
	Female,	9,179	2,788	1,492	1,074	781	15,314

Total deaths, in two States, under 5 years of age, 57,711.

Table showing for the United States and for 31 registration cities, the living population under 5 years of age, the number of deaths, and the number of deaths per 1,000 of living population, compiled from U. S. Census Report for 1880.

Ages.	United States.			31 Registration Cities.		
	Living population.	Deaths of corresponding ages.	Proportion of deaths per 1,000 living.	Living population.	Deaths of corresponding ages.	Proportion of deaths per 1,000 living.
Under one year, . . .	1,447,983	175,184	120.9	165,469	44,249	267.5
One year, ...	1,256,965	56,816	45.2	132,933	11,623	87.4
Two years, ...	1,427,086	33,417	23.4	162,715	5,977	36.7
Three years, ...	1,381,274	21,276	15.4	157,646	3,898	24.7
Four years, ...	1,401,217	15,931	11.3	156,913	2,824	17.9
Under five years, . .	6,914,516	302,624	43.7	775,676	68,571	88.4

Remarks.—In considering this table it should be remembered that the reports of deaths for the whole United States are defective from 15% to 30%, while for the cities they are nearly complete. It will be seen that for each 1,000 living under 1 year of age in the United States at large the proportion of deaths was 120.9; while in the cities the number of deaths per 1,000 of the same age was 267.5. Under 5 years of age the proportion of deaths in the country at large was 43.7 per 1,000 of living population, while in the registration cities it was 88.4 per 1,000. In other words, the mortality of children under 5 years of age, according to this table, was about twice as great in the cities as in the average of the whole country.

Table showing for the United states, for Massachusetts and for the principal countries of Europe, the number of deaths up to 5 years as compared to 100 deaths of all ages:

	Under one year.	One to five years.	Year.
United States,	23.24	16.90	1880
Massachusetts,	20.37	14.23	1880
Italy,	24.77	20.60	1880
France,	17.59	8.83	1879
Prussia,	32.25	15.96	1880
Bavaria,	39.48	10.71	1880
Saxony,	42.00	15.34	1880
Thuringia,	31.71	15.30	1880
Wurtemberg,	41.78	11.92	1880
Baden,	33.77	12.33	1880
Alsace and Lorraine,	28.74	11.96	1880
Austria,	31.62	16.51	1880
Croatia and Slavonia,	30.44	19.37	1880
Switzerland,	24.34	8.97	1880
Belgium,	25.99	13.09	1880
Holland,	31.01	14.10	1878
Sweden,	19.58	13.68	1880
Norway,	20.59	12.21	1878
Denmark,,	23.49	12.19	1880
Finland,	25.55	18.73	1880
European Russia,	38.82	20.81	1875
Spain,	22.93	25.20	1865–70
Greece,	18.09	17.30	1880
Roumania,	23.54	19.33	1879
England and Wales,	25.48	16.98	1880
Scotland,	20.31	17.37	1878
Ireland.	13.98	11.60	1880

Remarks.—It will be seen by this table that as regards the proportions of the infantile to the whole mortality, the United States is near the mean, being exceeded in the proportion of deaths occurring under one year of age by Austria, Belgium, England and Wales, Germany, Holland, Italy and European Russia, while France, Sweden and Norway, Scotland and Ireland, have a lower rate.

III. Economic Sanitation.

By ALBERT L. GIHON, A. M., M. D., *Medical Director U. S. Navy.*

As in nature all force, manifested in energy or power, is obtained through the equivalent exchange of some other form of impetus, so, even in the ordinary transactions of life, we find that whatever is efficient is the outcome of the expenditure of a proportionate amount of labor, or is purchased by labors equivalent, money. There are make-shifts and shams and Brummagem wares that are cheap, and their very cheapness is the measure of their worthlessness. The veneering pleases the eye—but there is nothing stable and enduring to benefit those that outlive the moment.

Sanitation, while not a commodity in the sense of a concrete object of barter, has its financial value—to be estimated like other mundane products by the cost of human skill and labor expended in its accomplishment. Unfortunately, the popular preference for cheapness without regard to worth, has led to an arbitrary valuation of the health-service not commensurate with its actual importance. The distinguished pleader before the Supreme Court of the United States receives a fee of five or ten thousand dollars for an apparently off-hand conversational discourse before a number of elderly gentlemen in silk gowns, but nobody questions the fitness of the reward, which comes after a lifetime of learning and experience. The president of a great corporation is given the salary of the ruler of a State, and seems only to have to sit leisurely a few hours daily in a handsomely furnished office, but the intelligence, aptitude and training which fit men for such a position are known quantities, and their value recognized. But, were it ignorantly believed that any glib talker could fill the pleader's place, or any well-mannered and well clothed individual could make a successful financial leader, the idea would be no further from the truth than that superficial estimate of sanitary work, which looks upon it as a matter to be accomplished by the outlay of a few hundred dollars and the employment of one or two subordinate clerks.

Sanitary establishments, like other important undertakings, involve qualified control and skilled labor, and both have easily computed market values, the requisite brain force and muscle force being the resultants of so much education and application; but, up to this time, through the disinclination to stint in ornament and luxury, the expenditures for sanitary objects have been reduced to a minimum, and the results obtained have been correspondingly limited. Nowhere is this more manifest than in places under the control of the State and National governments. The wretched sanitary defects of the Treasury Building at Washington, suggested an examination two or three weeks ago, which revealed a mess of hidden abominations in the Winder Annex to the War Department; and a just published report of the insanitary condition of the Ohio State House at Columbus, reads like a romance of horrors—with filth as the chief villain, and ignorance and neglect his wicked coadjutors.

The purport of the little I have to say on this occasion, is that sanitation—the thorough effective sanitation which saves life, secures health, contributes to wealth, comfort and happiness, is not cheap; and that the mistake which health officers have made and are still making, is accepting, under feeble protest, if any, the petty sums, grudgingly doled out by legislative bodies, as sufficient to accomplish, in any sense, the objects of their establishment. And, first, it ought to be understood that sanitary tinkering is worse than absolute neglect. A house, imperfectly trapped, is more dangerous than one reeking with

foul smells through the false sense of security given by its assumed protection; and the health board with its munificent appropriation of a few hundred or a thousand, or even two or five or ten thousand dollars for rent, salaries and executive acts, is a health board in name only, and the community under its charge fancies itself clean because it wears a clean shirt over a dirty body and festering sores.

Much time and argument have been expended in the American Public Health Association, State sanitary conventions, citizens' auxiliary sanitary societies and like assemblies, in establishing abstract propositions, that health is wealth, that the public health is the public weal, that an ounce of prevention is worth a pound of cure, that it is cheaper to keep out disease than to drive it out—and if the public are ever to be educated in the rhetoric of hygiene, it ought by this time to be in the Sanitary Sixth Reader; but it is this same public which has also been taught that the wages of sin is death, that what does it profit a man if he gain the whole world and lose his soul, that the sins of the fathers are handed down to the children of the third and fourth generation—and yet prisons are never empty, nor gallows idle.

It is futile, therefore, to depend upon mere preaching to bring about that change of heart that will move men to do what they ought for their physical welfare. Society must have *faith* in its medical men, and accept as truth what those qualified by education and experience tell them, and do what they advise—advice, the honesty of which can not be gainsaid, since aiming to banish disease, it actually lessens the professional emoluments which sickness brings. Sanitary instruction must now be supplemented by sanitary execution. The exposure of the evil to be corrected must be accompanied by the peremptory statement of the remedy, and in no uncertain terms as to quantity and cost. The Secretary of the State Board of Health of New Jersey says, in his report for the past year: "While it is still necessary to gather information for diffusion among the people, it is now far more important to educate individuals in the technical work of oversight, inspection and execution, and to perfect the details of sanitary administration." And this is the paramount duty of health officials—to put into practice what they have so long preached, which is not as easy a matter as it seems. The intelligent head may be there, but the many hands are lacking to do its bidding. The sanitary mechanism may be complete, but if there be no fuel to start its fire, it can not move; and on this humble substratum of the material all human efforts rest: the doing is dependent upon the means of doing.

Sanitarians have perhaps erred in proclaiming so widely that sanitary science is a very simple matter, which like phonography and the Spanish language, needs only the alphabet to be mastered, that the student may know in one lesson how to spell words of any number of syllables. Fresh air, pure water, good food, a clean skin, sound sleep,

temperance and exercise, are the seven simples, which like the straight lines, and curves, and dots and dashes, are able to express any combination of circumstances. But for all that, an intelligent head, a skilled hand, and a watchful eye are needed to combine them effectively. There are some physicians—it is true not of a very high order—who take pains to announce that they are therapeutists and not hygienists. This, partly through the shallow idea that there is greater dignity in treating a sick man than in preventing his getting sick, but chiefly because, in the language of one, he feared that the dissimination of sanitary knowledge would cause lawyers, preachers, merchants and mechanics to know as much as himself, and that, therefore, his occupation would be gone. This at least is certain, that the physician whose horizon hems him within a circle of such small diameter, does not himself possess the requisites for a capable and efficient health officer. Without a special dialect of polysyllabic Greek, or an exclusive scientific technicque to be gotten by heart, the sanitary service demands intelligence, information, judgment, skill in organization, executive ability, readiness of resource in emergencies, firmness, fearlessness, honesty, zeal, enthusiasm and self-abnegation, which are not every-day qualities nor everybody's characteristics. Recently said the Governor of a great State to a famous officer of a State Board of Health, "What are we to do should you die? Are you training any one to take your place?" The State Boards, which have accomplished the most satisfactory results and given preventive medicine its proper place in the van of scientific medicine, owe their success to their energetic and accomplished officers. These need not be named. Whoever has attended the meetings of the American Public Health Association—the common ground on which these men meet once a year—will recognize them. By their works they are known. All of them are able men—some with idiosyncrasies and personal peculiarities, which you or I may not like—but all of them zealous, earnest, indefatigable in the cause of public health. They have won their places by their merit, and hold them through its popular recognition, some of them already so long that State, cause and individual have become convertible terms.

Such men are the first essential to successful sanitary work, and it is greatly to the credit of our people that political party, religious creed and professional dogma have not controlled the personnel of those State Boards, which have accomplished the most marked results. Very recently we have witnessed the gratifying spectacle of the remaining members of a State Board, the Governor of the State, municipal authorities, neighboring sanitary organizations, press, pulpit, and people, uniting to protest against the resignation of a health officer, who had given so much time, thought and means to the board over which he presided, that he had almost forgotten there were domestic claims upon him as a man of family.

And this suggests what I desire to say as to the necessity for compensatory salaries for these men, who sacrifice personal interests and the opportunities for strictly professional gain, in the cause of public health. The sanitary service demands the ablest minds in the medical profession. and like the judges, who are drawn from the leaders of the legal profession, they should be secured a fixed income, befitting the dignity of their office, and enabling them to provide that comfortable maintenance of their families during their lives, and provision for their support after their death, which is every just man's ambition While adequately rewarded for their services, they should be guaranteed against this world's vicissitudes. The health officers who feels the pressure of the *res angusta domi* can not be expected to give that altruistic attention to his duties which is necessary. Neither should his remuneration depend upon the receiving of fees, which, if munificent, attract a brood of political cormorants, who expect to be fed from them. The evil sound of harpies' wings should never be heard about Hygieia's temples.

Unless the health officer's position is dignified andexalted, and correspondingly requited, only incompetent make-shifts will after a while be obtained, whose perfunctory performances will have neither value nor influence. Not yet have the sanitary officials of any State received the full measure of distinction and pecuniary reward to which their labors entitle them. but in their zeal for the development of this yet new branch of the public service, they have given their time without question of pay, and been content in the hope of winning the popular gratitude. Here, as in many other instances, calling for evidences of the loftiest humanity, enlightened Christian races may learn a lesson from the benighted pagan. Some of you may have heard the interesting address of the Secretary of your new-born State Board of Health, in which he portrayed the public state of the laurel-crowned and purpled toga-ed sanitary inspector of old Rome, and the popular ovation he received as his chariot passed on his daily round of duty. How many citizens of Philadelphia think to salute the chief health officer by lifted hat? How many know either his face or his name? Great as any judge or lawmaker, greater than any general or admiral, the minister of health is of right *primus inter pares*, the chief physician of the State, on whose wisdom its prosperity and security depend. His emolument, therefore, should be no insignificant sum, grudgingly given, but a generous competence bestowed upon him as the archiater, who has the power to make more of his fellow beings happy in the enjoyment of sound health than any other single individual. Practitioners of curative medicine, specialist therapeutists who limit their work of single organs and apparatus, pile up gold and greenbacks in stacks, while the man who would keep disease away from the community not only sacrifices his opportunities for personal enrichment,

but is not even recompensed for his actual work in the service of the public.

There is the same need for the liberal remuneration of subordinate health officials as for that of their seniors, to secure the efficient and zealous performance of their duty. The delinquent or venal sanitary inspector is as much of a nuisance, in the sense of causing damage, as any he is called upon to abate. In the service of the public health, as in the ministry of morals, there must be sterling integrity and unadulterated honesty; but it is asking too much of either that, in the absence of sufficient pecuniary return, they should be content with an uncertain quantity of the homage and gratitude of the community, which should supplement, not substitute, the former.

Well-paid, permanent officials are absolutely necessary to an efficient sanitary service, but the most liberal salaries and the utmost fixity of tenure of office will not enable the most competent officers to accomplish anything without command of abundant means, and *abundant* is what Webster defines it to be, "fully sufficient." The varying needs of different seasons and conditions are not to be met by the small sum which is annually appropriated for sanitary purposes. Let us cursorily recall what a health board has to do.

It has first to make a thorough sanitary survey of the city or town, and this involves what is termed a house-to-house visit and inspection of every occupied dwelling, factory or other resort of human beings, whether it be a Walnut street mansion or a Bedford street hovel—of every school house, church and theater, of every stable, cattle-yard, hogpen and wherever else animals are congregated, and of every warehouse and storage place of perishable materials; the actual examination of every bedroom, attic, kitchen, basement and cellar, of every storeroom and out-of-the-way closet, of all alleys, yards and outhouses and the critical inquiry into their drainage, sewerage and ventilating systems. Velvet carpets and downy beds are no safeguards of health against a siphoned or unventilated trap, nor can the costliest and wisest master in medicine undo the damage wrought by one open soil-pipe joint or one broken drain under the rich man's basement—damage, perhaps, as great as that from the soggy, rotten floors of a rag picker's filthy, underground den. The mere labor of exposing and opening to the light and air every unclean and unwholesome apartment, of requiring them to be drained if wet, of having their decayed wood taken out, their noisome rubbish removed, their walls whitewashed, of having accumulated refuse carted away from obstructed alleys and back-yards and neglected lots is more than any existing health board can do thoroughly with the means at its disposal, and this is only part of its duty.

In most cities, notably your own, the supervision of the cleaning of the streets is a task for Hercules, and the proper performance of this duty implies not a mere superficial sweeping of a few principal through-

fares, but the actual *cleaning* of every street, by-way and alley. If every scoffing councilman will dig from between the cobble-stones of the street before his own dwelling some of the fetid slime which has lain there for years, and bring it within smelling distance, he will need no other inducement to vote a liberal appropriation for this one office of the health department, and if he will carry it to some friend, with a microscope, who can show him the living swarms which multiply there, he will double the appropriation. The experiment may likewise be commended to the doubting Thomases among the citizens, who may thereby learn to control their selection of municipal legislators, strengthening their convictions, if need be, by lingering a moment over a corner sewer inlet or by going from the fresh out-door air into their own closed cellar, or for that matter by merely entering some crowded school-room an hour after the day's exercises have begun.

Nor are the inspection of houses and cleaning of streets all that come within the province of the sanitary officer. He must see that every newly erected building is properly plumbed—and I would like to know how much money this great municipality annually appropriates for this one matter of the inspection of plumbing. Consider what it involves: The critical examination of the drainage and plumbing plans of every building erected in the city, the personal inspection of every house in course of erection, alteration and repair; and in Washington these inspections are thrice repeated—first when the iron drain-pipe is laid underground and is filled with water and required to remain full until seen by the inspector; next when the vertical and waste-pipes are attached and these likewise filled with water and required to remain so twenty-four hours to discover leaking joints; and third, after all the fixtures, water-closets, bath-tubs, wash-tubs, basins and sinks are in place, properly connected, the water turned on from the street and everything in working order. Is there any one part of this procedure which is unnecessary? Is it a duty that should be entrusted to careless or incompetent? And yet, what provision have you made to secure careful and competent hands to do this work?

But the health officer's duty does not stop at the city's confines. He must follow the subterranean streams of sewage to their eject upon river or sea, and thence until they are dissipated beyond harm to any human being. The thin veil of earth which hides them from sight is but a cobweb cuirass against the germs and noxious gases that are sought to be imprisoned.

Nor is this even yet all the health officer is expected to do. He must see that the garbage from the kitchen, the offal of the slaughter-house, the muck of the stable and drove-yard, the waste products of the factory, the débris of every human industry, and the dead of the animals, who, whether the foe or slave or friend of man alike partake his civilization only to experience his neglect, are all removed. He has, besides, to prevent the sale of spoiled meat and other unwhole-

some food, to inspect the vegetables from the kitchen-garden and fruit from foreign ports, and discover that which is unripe or rotten, to detect stale fish and oysters and other marine products, whether in the fisherman's smack or on the dealer's stall, to arrest the vendor of impure milk and expose frauds in butter and cheese, and to guard against the pollution of the water supply; for since by civilization earth, air and water are all contaminated, by civilization should this befouling be removed. Even the drugs, on which men lean to cure them of the evils they have invited, are also adulterated, though this is a counterfeit with which, perhaps, in the interest of health, the sanitary officer will do well not to meddle.

Our list is long enough of sanitary exigencies. Is it reasonable to suppose all this can be done for any petty sum? As well try to economize by feeding the hungry child with half a loaf when it needs a whole one. Our rough outline of the parts of a health organization, calls for sanitary inspectors of dwellings, schools and factories, inspectors of plumbing, inspectors of sewers, inspectors of streets, inspectors of food, meats, vegetables, fruit and marine products, inspectors of milk and inspectors of water, garbage collectors, pound masters, and the bureau officers to control and direct all the various operations, record their results, and collect the vital statistics of births, deaths and disease, which are now regarded as the gauge of the condition of the social system and the measure of its vitality.

Should any health organization hesitate to declare that an elaborate and complete sanitary establishment can only be maintained at a considerable expense, and that it is a false economy which, through neglect, invites a hundred times the actual expenditure of money to repair disaster, a thousand fold its value in interrupted business and diminished incomes, and immeasurable calamity in stricken hearts and desolated homes? It is not impossible to bring to each individual the realization of the fruits of parsimonious sanitary administration. Estimate the expense for medical attendance, for medicine, for special food, and nursing during the progress of a case of typhoid fever, and add to it the loss from interrupted occupation, if it be the provider of the family who is ill, and the instances are innumerable where imperfect plumbing in very stately dwellings has brought all this upon its luxurious occupants as where the foul cesspool beside the laborer's cabin has poisoned both the water from the well and the air, to whose stenches the senses had been blunted. Would one dollar a year for each individual in this great city be considered a burdensome assessment as assurance against this one form of preventable disease—but does your Health Board have anything like the million dollars this would signify? I do not mean that rich and poor alike should contribute an equal numerical quota—that the poor man with wife and eight children should give ten dollars of his hard earnings, and the rich man, with his wife and the rich man's average of but one or two

children, only three or four dollars. In the natural order of things, the wealthy must give of their abundance for the general good; but in estimating the sanitary requirements of a community, rich and poor young and old, are so many similar units, with such equal claims to protection against disease as the social organization provides for person and property against violence and anarchy.

A child is killed by diphtheria, and the cause discovered in its own dwelling, or, more likely, in the school-house, or if an operative in the factory, and through that child another and another victim fall. Can any money value express the real loss from this stint of sanitary supervision against this one preventable disease? Will a dollar a year weigh but as dust in the balance against it? Will the single dollar on one side of your profit and loss account appear as anything but an insignificant pen-stroke against the long array of figures required to balance the debit on the other page? Not long ago, a New York shop-keeper dropped a ten dollar gold piece, and carelessly handled a lighted candle seeking it, setting fire to his place, and causing a loss of ten thousand. Immeasurably more disastrous is the economy which is all eyes after this one dollar, and is carelessly blind to the spark which kindles into a devastating conflagration. The Secretary of your State Board has put into significant black and white the cost of your last epidemic of small-pox, that of 1870–72, and the small sum which might have prevented it: on the one hand twenty-five million dollars; on the other, twenty thousand. There are many here old enough to remember the yellow fever outbreak of 1854, for which economic sanitation was to blame, and which, in a few months, inflicted upon this city a loss exceeding a century's appropriations for sanitary objects.

City, State and Nation vote liberally for educational purposes, and the people of this country clamor for general education as one of their inalienable rights; but neither National Congress, State Legislature, city council, nor the people, stop to think that that education, which aims to develop and improve the mind, while wholly ignoring the body, will surely be pernicious to the child and disastrous to the race. An article in the *Chicago Current*, by LeRoy Griffin, pertinently contrasts the consideration given to cattle and to children. An outbreak of pleuro-pneumonia or hog cholera, promptly becomes the object of international concern, and commissions are appointed with the widest latitude of expense to investigate and provide a remedy; but scarlet fever or diphtheria may decimate a community, and the health officer is left to his own resources, and these are no money and little authority

I do not feel that I am here wholly in the garb of gues', for though so long expatriated, the spots which marketh the native Philadelphian cannot be erased, nor the clipped vowels from my tongue; consequently I do not abuse your hospitality, while congratulating you on the

institution of a State Board of Health, in expressing the mortification I have felt that this great Commonwealth has been only the thirty-second among these State Republics in learning that an efficient Bureau of Health is an indispensable part of the governmental mechanism. The regretable example, which this Keystone of the Union has set with such pernicious influence, is aptly illustrated by the promptness of its neighbor, Ohio, in following its later better patterning. To-day, only five States, Florida and Vermont, Nebraska, Nevada and Oregon, are without State Board establishments, which Massachusetts, to her lasting credit, initiated in 1869, and California, then Minnesota, Virginia, Michigan, Wisconsin, and others successively imitated.

Now that you have a Board, and one admirably officered by experienced sanitarians, it behooves you, citizens of the Commonwealth, to see that it is given power to do its work by your generous support. If you would reap abundant harvest, the seed must be thickly sown. The perfected and costly apparatus of your fire department is not required for every incendiary flame, which often a bucket of water or a hand grenade would have extinguished, but the havoc which may be at any unexpected moment, were that perfected apparatus not ready for any emergency, would in a single day exceed its cost for a generation. At this very moment, grave and reverend senators are hesitating to authorize the expenditure of a few thousand dollars—less than the cost of a congressional funeral excursion—for a commission to visit Cuba, Mexico and Brazil to definitely ascertain the facts about the claims of Freire and Carmona to the discovery of a means for preventing or modifying yellow fever, lest it might be found these claims are groundless, without considering the alternative possibility of saving thousands of lives and millions of money. The French Government did not hesitate to send a commission to Spain, which exposed the worthlessness of Ferran's methods; the German Government dispatched Koch to India; and the British Government has just appointed a commission of the highest scientific character to ascertain the truth as to Pasteur's reputed success in averting rabies.

Many years ago, an old style commodore found fault with me for invaliding so many officers and men from the Isthmus of Panama after attacks of Chagres fever, complaining that many of them got well by the time they reached New York, as though that were not the very reason for sending them out of a climate where they would have died or been permanently injured. Just as illiberal is the spirit which withholds the wherewithal for the efficient operations of a Health Board whose aim is to banish preventable disease. The fact that no disease occurs is the splendid argument for the wisdom of the provision. Hold back the necessary means, and I have but hastily shown you that the intended virtuous economy is only vicious parsimony; then, should disaster come, whether to you or to your neighbor, let the evil be upon your own heads.

IV. Sewering and Draining Cities.

By GEORGE E. WARING, JR., *Of Newport, R. I.*

I have been announced to read a short paper on the sewering and draining of cities and towns. This is rather a large subject for a short paper. All that it will be possible to do, will be to state very briefly some of the leading fundamental principles on which the sewering and draining of towns should be based.

There are two aims to be accomplished: One is to increase the convenience and comfort of living; and the other is to lessen the danger to health and life.

For the convenience and comfort of domestic and municipal life, it is important that water which falls from the sky, and water which rises into the ground, from springs or otherwise, should be removed in such a way that cellars shall never be flooded, and that accumulations of water on roofs, yards and streets shall be carried away without doing harm, and without rendering walking or driving inconvenient or uncomfortable. The best result will generally be attained if these objects are considered by themselves.

So far as the water of the subsoil is concerned, if it has a tendency to rise to the height of cellar floors, or even to the surface of the ground, some means should be provided for carrying it away by a sufficiently deep system of underdraining. If this were the only thing to be done, it might best be accomplished by exactly the same method that is used for draining farm lands—that is to say, by giving it a free means of escape at a level lower than that of cellar floors. In this way, we can get rid entirely, and without trouble or great cost, of what when neglected constitutes a widespread nuisance.

The water which falls on the roofs of houses, and is led to the ground by leader pipes, should be delivered to some point of proper outlet without running into the foundations of houses, without making an inconvenient wash over yards or paths, and without flooding sidewalks. Very generally, the best way to accomplish this is to lead it through pipes as far as the outer edge of the sidewalk, delivering it into the street gutter or into an underground conduit, as may seem best.

When delivered into the street gutter it joins the street wash, which the gutter is primarily intended to carry, and the two volumes combined constitute the surface flow which it is the object of storm-water drainage to remove.

It is a question to be regulated by economical considerations, whether or not to make the drainage provision such as to take care of all the water of exceptionally violent storms, or only to provide for such storms as, from their frequency, would constitute a regularly re-

curring annoyance. It often costs more than it is worth to make our works so large as to take all of the water coming with great storms which fall only at long intervals, and which continue for a very short time. All that it is generally wise to do with reference to such storms is to make such provision as will prevent their doing actual damage to public or private property.

Having determined the volume of rainfall for which it will pay to provide—assuming still that the removal of storm water is the only thing to be considered—it will be prudent and proper to depend on well-formed and well-made and well-graded street gutters to carry the whole flow, as far as they can carry it without too frequently flooding the sidewalk or the street. Whatever the conformation of the surface, whether steep, flat, or broken, a careful study should be made of the whole situation, and grades and gutters should be so established as to make the points of excessive accumulations as few as possible. These being established, lines of underground sewers, or drains, which for storm-water work only may be laid very near to the surface, should be run by the shortest and most economical course to the nearest safe points of outfall.

Considered and treated in this way, the underground work necessary for relief from floods will ordinarily not be serious, especially as there is nothing in the character of such floods, if streets are decently cared for, which will make it objectionable to deliver them into runways or water courses near by.

In this connection, if is well to refer to an old and cherished statement, which has constituted a standard and uncontroverted argument among engineers for many years, but which in my judgment is not well founded.

The argument prevades pretty nearly the whole literature of the subject. Baldwin Latham states it as follows:

"A very slight amount of investigation will show that the sewage of the northern towns, in which midden-steads are generally adopted, is, as a rule, quite as impure and nearly as great in volume as in districts in which water-closets are universally used; while at the same time the sewage contains nearly as large an amount of puterscent organic matter as in a water-closet town." He then gives the often used list of certain towns in England, in some of which there are water-closets and in others of which there are not.

There has been a sort of tacit acceptance of the idea that this means that street wash is as foul as house drainage. All that it really means is that there is so much filth due to other sources in domestic and municipal economies that the addition or subtraction of mere water-closet matter is of small account. It by no means proves, or tends to prove, that the filth to be dealt with in artificial drainage is largely due to street wash. It is really due much more largely to kitchen and laundry waste and chamber slops than to anything else. There is no rea-

son why any of these should be delivered into the street drainage. Being withheld, the water flowing over the surface, or even tolerably well kept streets, is not to be considered as sewage at all, and there are few cases where it may not safely be delivered into water courses near the town.

The removal of subsoil water and surface water being considered as a proposition by itself, it is generally only a question of economy whether or not to deliver it in connection with the foul wastes of the community.

Considering also, by itself, the question of dangers to health and life, while we may disregard surface water we cannot disregard subsoil water. Where this exists within the depth to which cellars are dug, it is very apt to constitute a somewhat serious sanitary objection. This, however, is not what we have chiefly in view in discussing problems of municipal sanitary drainage. Reference is made chiefly to the removal of the more or less obvious, but always dangerous, nuisances caused by our methods for treating waste organic matters.

All such matters which are of a putrescible character, whatever their origin, should be completely and entirely removed, not only from the house but from the town, before they have had time for their decomposition to begin. In their fresh condition they are rarely a source of danger, and, with the single exception of fæcal matter, they are rarely a source of foul odors. If we can deliver them into a sufficient volume of water to smother the excrement that they contain, and can get them out of the town promptly and efficiently, the whole problem is solved so far as our interior work is concerned.

This may seem a very simple statement to make, and it may seem to suggest a very simple remedy for our trouble. It becomes less simple when we consider what it involves.

It involves such a reconstruction of every defective water closet, or trap, or waste-pipe, or house drain, as shall ensure absolute cleanliness in all of these items. That is to say, it involves a reconstruction of the drainage work of ninety-five out of every hundred houses in the town.

It involves such a reconstruction of local drains as will tighten every joint, and keep their water inside of them, to perform the cleansing duty for which it is intended, instead of leaking away into the ground and leaving the solid parts of the sewage to lie in the drains and rot for want of a current to carry them forward.

It involves the abolition of every cess-pool and privy vault in the town.

It involves also the abolition or reconstruction of every sewer of which the water-way is so large, or so rough, or so leaky that it will not carry its whole flow all the way to the outlet. It involves also some means for preventing the accumulation of coarser matters near the upper ends of the lines, which is inevitable even in the smallest

and best made sewers along those portions where the natural flow is not enough to wash away the solid substances as fast as delivered.

In short, it involves a system of house and town sewerage of which there are very few examples anywhere in the world.

Having secured such a system of house drainage and local street sewerage as will accomplish this end completely, there arises the question, which is to be decided largely by considerations of cost, save where this is overborne by the considerations of disposal, whether to carry away the surface water from points of local accumulation and the foul drainage from houses, etc., by one set of conduits, or by two. If there is a safe point of outlet, not too far removed, where in cold weather and in warm, in wet weather and in dry, the whole volume can be safely delivered, as it could be if it were run into the Mississippi river, for example, it may be cheaper, and if it is cheaper it will better to deliver the two together.

Where such a point of outlet does not exist, or where it can be reached only at great cost, owing to the necessity for building large brick storm water sewers for a great distance; or where sewage is to be treated chemically or agriculturally for its purification; or where it has to be pumped, there it will generally be found best to get rid of the storm water by the shortest route and in the cheapest way, and to go to the expense of laying conduits for pumping or for purification only with reference to the smaller and more regular flow coming from house drains only.

Even where there is no objection to increasing the sizes of all the sewers throughout all the streets, and delivering storm water into them directly, the increased size required for storm-water sewers indicates the policy of using such sewers only so far as to the points of accumulation of surface flow already referred to.

We all know, of course, that the method of sewerage that is practically universal in Christendom is to take all of the water of light rains, and as much as we can compass of the water of heavy rains directly into the foul-water sewers. The statement is often made that all necessary considerations of economy will be satisfied, so far as the size of the outlet or the cost of purification or pumping is concerned, by establishing storm-water overflows by which when it rains more than a very little the surplus flow will be delivered directly at some near point of outlet, only the minor flow passing on through the smaller main.

There is a fallacy here to which attention may well be called. The volume of sewage discharged from houses varies with the time of day and considerably with the day of the week. It is ordinarily very much larger for a little while during the forenoon of wash-day than at any other time during the week. If the storm overflow system is used, of course the overflow point must be placed high enough not to allow this wash-day flow to escape. It must surely be high enough to carry all such volumes safely forward.

As outlet sewers are generally constructed with a view to a large future increase of population, the overflow must be placed high enough to provide for such population, often many times the number that will have to be dealt with for some years to come. Now, that point being fixed and the volume of sewage that will always be sent through the larger and smaller outlet sewer being regulated by the height of that point, we find, in practice, that all of the water of moderate rains, continuing sometimes for days together, has to be carried to the distant outlet for pumping or for purification; and a simple calculation will show that outlet provision ample for the mere house drainage must, because of the need for carrying and treating all of the storm water that can run below the overflow point, be enormously increased, at a corresponding increase of cost for pumping and purification, where these are needed.

I have purposely avoided all references to details of sewerage work, and have attempted nothing more than to lay before you a few cardinal points which it may seem worth while to consider and to discuss. More it would hardly be possible to do on such an occasion as this.

V. The Financial Aspect of Sanitation.

By ALFRED LUDLOW CARROLL, M. D.,

Of New Brighton, N. Y., late Secretary and Superintendent Vital Statistics, State Board of Health of New York.

Political economists tell us that all advances in civilization are founded on "enlightened self interest" rather than on philanthropic altruism, and the most superficial observation of human nature corroborates this axiom as regards the average taxpayer and his legislative representative in this Republic. The "practical" business man is generous enough in giving his money voluntarily for charitable purposes, but he strenuously protests against any increase, however small, of the demands on him as a member of the body corporate, unless he can see a prospect of a profitable return from the investment. This is peculiarly the case in the matter of sanitary improvements, concerning which the arguments that have usually reached the public ear have been directed more to the emotional than to the commercial instinct. The sturdy citizen whose robust constitution saves him personally from endemic disease, will resist any expenditure for general hygienic protection of the community, although he will willingly contribute much more than his share of such expenditure for hospitals and asylums, to care for his neighbors who succumb to preventable maladies; and the only way of inducing him to subscribe his "ounce of prevention" is to convince him that the actual money profit

of saving life and health is as great as that from the most successful speculative venture in the stock exchange, or the most absolute monopoly in a railway franchise, and much more certain than either.

No argument is needed to support the self-evident proposition that that the worldly prosperity of a Commonwealth is the aggregate of the average prosperity of its component citizens. As Jarvis, in his excellent essay on the Political Economy of Health [Fifth Rep. S. B. H., Mass.], has happily phrased it, "Every increase of individual estate, every dollar earned, and every new value created is so much addition to the Commonwealth, and every detraction from the wealth of individuals, every dollar that is expended without return, wasted or squandered, every extinguishment of any value is so much taken from the public capital." It is obvious that if a man earn more than the cost of his subsistence, the surplus is so much added to the general fund, while, on the other hand, if he cost more than he earns, the deficit is a burden on the community at large; or, to put the statement in conventional politico-economical form, the accumulating wealth [of the community, as of the individual], is the excess of production over consumption. It is further clear that the premature death of a productive individual, like the destruction of any other source of revenue, represents the loss of a certain amount of income, and that his withdrawal from productive industry through sickness, signifies the suspension of such income plus the additional cost of attendance during his illness. With a knowledge of some of the facts collected by vital statistics, and a good table of "present values" of annuities, these losses can be calculated with as much accuracy as any of the actuarial data on which insurance premiums are founded, a simple formula being that "the present value of the person's future earnings, minus the necessary outgo in realizing those earnings, is the present value of that person's services." [Farr.] That is to say, if a person whose earnings exceed the cost of his subsistence by $500 a year, die twenty years earlier than the natural termination of a healthy working lifetime, the loss to the community is the present value of an annuity of $500 for twenty years, *i. e.*, at six per cent., $5,735. The money-worth of the individual, therefore, varies with his earning capacity and his living expenses; and with the postulate that the average productive period of life is between the ages of twenty and seventy, we have a basis for tabulating the profits of each class of incomes. According to Farr's elaborate computations, while the value of a Norfolk agricultural laborer at the age of twenty-five is £246, the value of a professional man earning £300 a year is about £3,000, or, as he otherwise puts it, "the loss or injury of a carriage full of curates might not exceed £30,000, while the loss on the life of two bishops might raise claims for a larger sum. "In the death of a minor, our loss is not only the present value of a "deferred annuity," representing the probable earnings of his manhood, but also the amount spent

in his maintenance during unproductive childhood. It is, of course, manifest that the earner who has a probability of forty years of future industry is worth more than him whose "expectation" is but twenty years. Knowing the relative numbers at different ages and in different occupations, it is an easy, though tedious, task to determine the average of these various factors, and to reach the mean value of the individual. From the immense mass of statistics at Farr's disposal, he demonstrated that "the minimum value of the population of the United Kingdom, men, women and children, is £159 a head; that is the value inherent in them as a productive, money-earning race." In North America, with its larger wages and higher rate of interest, this estimate should be increased in the proportion of rather more than 30 per cent., and without adducing the differential calculations, which any one may make for himself, from a comparison of Farr's statistics with those available here, it may be broadly stated that the minimum value of a human life in the United States is at least $1,000.

To the unthinking mind, a reduction of the annual death rate per 1,000 of population from 22 to 21 may seem almost insignificant; but when viewed from the above pecuniary standpoint, it will be seen to mean, even in a town of 10,000 inhabitants, an annual saving of 10 lives, equivalent to a gain of $10,000, which would yield 10 per cent. profit on a capital investment of $100,000; and if we extend the same estimate to a population of 50,000,000, we get a revenue which at the same rate would justify an outlay of $500,000,000; in other words, we, if the cost of the needed sanitary improvements to produce this small decrement in the death rate required a contribution of $10 from every inhabitant, the return would be greater than could be realized from almost any other investment. But neither is the cost so large nor the profit so limited. With far less expense the mortality has been vastly more reduced and the duration of life increased by millions of working years in a generation. Thus, in France the average length of life has been augmented ten years within the last century, an aggregate of about 400,000,000 years for the total population; in London the death rate per 1,000 has been reduced from 50, in the eighteenth century, to less than 22, a profit of over 100,000 lives a year; and there have been numerous instances within the past half century of diminutions of from twenty to thirty per cent. in death rates. As a farther item to be remembered in balancing our public ledger, it must be borne in mind that for each death 26 persons may be assumed to be seriously ill, aggregating two years of sickness; and that on an average the cost of supporting and treating each patient is half as much as he would earn if well. Now, the ideal natural death-rate of a perfectly organized community, where old age should be the only cause of mortality, would not exceed 10 per 1,000; but without aiming at this Utopian model, sanitarians are agreed that a ratio of 17 for even large cities, and 15 for the population at large,

ought to be practically attainable; and whosoever will examine the official records of the majority of urban or rural corporations may count the enormous gain to be made by such a reduction.

Among the preventable diseases which should be most easily controlled, are the commonly known infectious zymotic maladies, and these, in the mortuary returns of different places, constitute from 13 to 24 per cent. of the total mortality. As regards typhoid fever and diarrhœal disorders, experience has over and over again shown that proper methods of sewage disposal and pure water-supply have sufficed nearly to abolish them. Indeed, the whole class of "filth diseases" could be banished from our nosology by ordinary attention to sanitary cleanliness. Malarial fevers, which in many districts cripple productive industry in greater proportion to their mortality than any other ailments, may be virtually exterminated by efficient soil-drainage, and not alone these, but consumption, which in temperate climates plays the largest part in the death roll (causing in the State of New York 14 per cent. of the whole mortality), has been shown to be intimately associated with dampness of soil, and has in several recorded examples been diminished 50 per cent. by drainage works. A similar reduction in New York, including the comparatively small mortality from malaria, would be tantamount to an annual revenue of six and a half million dollars, to say nothing of the enhancement of the value of land, if only for agricultural purposes, an enhancement which has often reached tenfold of the original valuation. Aside from the disorders directly dependent upon infection or local insanitary conditions, whether municipal, domiciliary, or industrial, public hygiene ultimately much widens its preventive range by increasing bodily resistance to, and diminishing the fatality of other classes of diseases, even of constitutional or developmental types, and by raising the general standard of health increases productive capacity.

To take more definite figures, Simon proclaimed some years ago that about 120,000 preventable deaths occurred annually in England and Wales, and Chadwick supported the same result; in France, by a similar computation, the number may be placed at about 250,000; in Spain, about 190,000; and in the United States, Billings reckoned from the census of 1870 that the annual deaths from causes known to be preventable were "certainly over 100,000," an estimate which may now probably be raised to over 160,000, and he adds, "if we were to consider theoretical possibilities rather than actual probabilities, these figures might be doubled." If to such lethal losses we add twice as many years coincidentally withdrawn from production by serious illness, the aggregate appals the imagination, and dwarfs the most destructive ravages of war to insignificance. Setting aside all sentimental considerations, and regarding it only in its financial aspect, it means that in this country alone an annual loss of $208,000,000, and

an annual cost of more than $24,000,000, at the very lowest estimate, are taken from the public fund by preventable death and illness, and that the saving, or, more properly speaking, the gain of this sum would yield cent. per cent. profit on a capital investment of $232,000,000. Can the most visionary dreams of speculative ventures offer so alluring a revenue?

VI. On the Sanitary Significance of Sporadic Typhoid Fever.

By PEMBERTON DUDLEY, M. D.,
Of Philadelphia, Member State Board of Health of Pennsylvania.

It is not the intention, in this paper, to offer any facts or inferences that are not already well known to all enlightened physicians and to many other intelligent people. The whole subject of typhoid fever—its origin, its propagation, its progress and its tendency, are familiar enough to those who make special study of such subjects; but there are few infectious zymotic diseases, upon which the general public is more in need of enlightenment than this prevalent and dangerous malady, and especially is this true as regards its cause and origin. The fear of infection inspired by small-pox and scarlet fever is less generally and less acutely felt in the presence or imminence of this less actively contagious disease, and the means employed to avoid the former are not thought so necessary as safeguards against the latter.

But the gravest misconception of typhoid fever by the general public, consists in an entire misapprehension as to the specific nature of the agency that produces it. Indeed, if we judge from conversations frequently heard in reference to it, we might almost be led to infer that the disease comes on spontaneously, and without assignable cause. Physicians know, of course, that such things cannot be. Driven to the point by close questioning, they all admit the specific character of its cause, yet how frequently do they seem to manifest very little interest or desire to learn just how any particular case had its beginning. A patient attacked with variola, or measles, or scarlatina, elicits at once the professional inquiry, "Where did he get it?" "How did this unfortunate occurrence happen?" "Where and when did the exposure occur?" Are these questions always, or even generally asked, respecting a case of typhoid fever; and if not, then why not? I am becoming pretty well convinced, from the observations of the past few years, that this latter disease can be traced to a definite cause in nearly all cases, at least in our large cities.

It can do no good to inquire particularly how the present crude and erroneous notions respecting the probable and possible and almost multitudinous agencies, ascribed as causes of typhoid fever, came to

exist in the public mind. It is enough to know that these notions must have sprung out of the narrower professional knowledge of the years gone by; but in the light of present information, professional failure to disseminate more correct views can hardly be excusable.

The notions of the ancients respecting the causes of epidemics are sometimes held up as evidence of the dense ignorance of those early times, and of the exceeding incapacity of even the world's brightest minds to reason back from results to causes. We smile at their fears lest some one of the deities, of which they possessed so abundant a supply, should vent his anger by the out-pouring of some dire plague upon the hapless people. But when we pride ourselves upon our freedom from these superstitions, let us for just a moment remember that Milton's allusion to the comet that, "from his horrid hair, shakes pestilence and war," originated on *this* side of the Dark Ages, and that Webster's book on comets as the cause of epidemics is less than a hundred years old. Perhaps it may also promote in us the virtue of humility, if we recall the fact that twenty-nine years ago an epidemic of typhoid fever in the National Hotel at Washington, which threatened the lives of President Buchanan and his Cabinet Ministers, was ascribed to the infernal machinations of the opposing Whigs. Right in our own day it is not at all unusual to hear cases of typhoid fever attributed to overwork, either physical or mental, to loss of sleep, to mental anxiety, to general debility, etc., etc., and we—we physicians, I mean—fail to embrace the splendid opportunity thus presented, to read a brief and pertinent lecture on cleanliness. We allow these popular delusions to remain undisturbed, and overlook the fact that in the light of present science they are scarcely less irrational than those which attributed the invasion of an epidemic of typhoid fever to a comet or an earthquake, to the anger of the gods, or the disappointment of the Old Line Whigs.

It ought not to be difficult to convince people of ordinary intelligence, that a disease whose essential features are of so constant and unvarying a character as are those of typhoid fever, cannot be reasonably supposed to originate from inconstant and diverse causes, but that its cause must be essentially the same in all cases, or as the doctors express it, it must have a "specific" origin. Its unvarying course and succession of changes, its well defined stages, its equally definite duration, its constant anatomical lesions, in intestine and spleen and skin and mesentery—such an invariable succession of phenomena, such a uniform series of manifestations,—must have *one* cause, and *not* a dozen. Overwork, mental anxiety, night vigils, may open the gates of the body to the invader, may increase its susceptibility, but can cause the disease, never! These facts, so familiar to all physicians, ought to be as firmly impressed upon the public mind.

That the greater proportion of cases of typhoid fever occurring in our large cities are due to an infection derived from preëxisting cases,

needs no argument to commend it, and certainly can be scarcely doubted. The same thing is undoubtedly true of numerous cases in which the cause remains undiscovered. But I have never been quite willing to reject finally and totally the view of the late Dr. Murchison, that under certain favoring conditions the disease may originate *de novo*, perhaps from some decomposition-product generated or modified in human excrement, or in decomposing organisms. Neither am I discouraged in the least by the assertion that such a view implies the possibility that small-pox, syphilis, etc., may also originate anew. If we deny this possibility we must logically admit the proposition that these contagions first arose from some natural conditions and processes such as cannot occur again in the world's lifetime, or else we must ascribe to them a miraculous origin either during the history of our race, or else amid the creative glories and purities of the Garden of Eden. The instances in which typhoid fever invades the isolated homes of rural districts, in most of which, no possible communication can be traced with any other case either near or remote, are too numerous to be explained on the theory of an invariable contagion. Discussion of this question, however, is scarcely in place in this paper, or indeed in this convention, unless it can first be shown that upon its decision rest the sanitary questions pertaining to typhoid fever. Fortunately it happens that I am not placed under any such obligations. All writers agree that the emanations from decomposing night-soil and disintegrating organic tissues, do in some way or other increase the prevalence and virulence of the disease under consideration. Even if they never, under natural conditions, constitute the essential cause of typhoid fever, they undeniably increase, and very greatly increase, the susceptibility of those exposed to their influence. Hence our duty as sanitarians seems to be scarcely affected by these etiological questions upon which our pathologists are divided.

The most important lesson to be learned by the public in reference to typhoid fever is that it is a "filth disease"—not sometimes, not generally, but *always*. And perhaps the next in importance is, that while the production of the disease probably requires that the morbific agent shall be brought into contact with the alimentary mucous membrane, as in food or drink, it is possible for the salivary fluids in the mouth and throat to absorb the poison from the atmosphere, and thus become the medium of its transmission to the stomach. There is also a third lesson, of no less value to us, viz: That various articles of food, and especially milk, water and other fluid foods, possess the same property of absorbing the fever poison from the atmosphere and thus becoming the vehicles of its introduction into the system.

My own observations are fully in keeping with the view that the absorption of the poisonous emanations by the salivary secretions, and by food stored in pantries and kitchens, but especially the latter, furnishes the explanation of nearly all the so-called "sporadic" cases of

true typhoid fever occurring in this city. In a large proportion of the cases it will be discovered on examination, that odorous emanations from kitchen drains, but more frequently from privy vaults, are easily perceptible to the senses in the rooms where food is stored and where it is being prepared for the table. In most of the observations I have made on this subject, it has appeared to be the privy vault, rather than the drain, that has been responsible for the evil. Let me describe two instances in which, as I think, the cess-pool was at fault. But remember, I do not offer these cases to *prove* my point, but only to *illustrate* it.

In September, 1885, I attended a boy aged seventeen, suffering with a mild yet pronounced typhoid fever. The house fronted on a narrow lane which terminated in a blind extremity, and which, like all other lanes of that peculiar character in this city, was closely packed on both sides with brick boxes, called "houses" by way of courtesy. Back of the house a three-foot alley ran parallel with the lane, but immediately after passing my patient's back yard, it turned away at right angles toward another and parallel street. Little houses backed against this alley-way on both sides of its long arm and against one side of its shorter arm, but each house had in its rear a little narrow space—called a "yard"—which was large enough to hold a privy vault, and not much more. The arrangement was such that within ten or twelve feet of my patient's kitchen window there were four cesspools, and within thirty feet there were ten of them. The whole vast, infernal machine was completely shut in from lateral air-currents, and the noisome odors were distinctly perceived in every room of the house. I learned of no fact leading to the inference that the patient's disease had been contracted elsewhere, and indeed it seemed almost unnecessary to search for such evidence. Strange to say, there was not any more sickness in the immediate vicinity than is generally found in such localities. I am perfectly willing to attribute to these cesspools, *not* the transmission, but the *origin* of my patient's sickness.

The other case that I shall mention is destined to become historical. In August, 1885, I was ordered by Dr. Lee, the Secretary of our State Board of Health, to investigate the sanitary condition and management of a certain house, located on a corner of one of our widest avenues in the north-eastern quarter of the city. Dr. Lee's letter contained suggestions as to the scope, and hints as to some of the directions which my investigation should take. I made repeated visits to the locality, and spent many hours in tracing out every possible clue to the information I was seeking, and was forced to limit my conclusions to the condition of the premises alone.

The house extends in its length the entire depth of the lot, but does not occupy its entire width. Originally the yard, running alongside the house, had a length of some forty feet, but a one story kitchen

was built, which jutted out from the side of the house, cutting this yard completely in two. The front portion of the yard has a front of twelve and a depth of seventeen feet. The back portion has been still further encroached upon by a frame dining-room extending its whole length, so that it is now reduced to the dimensions of fifteen feet by three. At the rear end of this narrow space is a cess-pit, which encroaches three feet upon the length of the space, reducing it finally to thirty-six square feet—just one fourth of the minimum size now demanded by law. The privy is *ornamented by a sham ventilator, which rests upon, but does not penetrate, its roof.* The pit is some three or four feet in depth. Backed against this privy is a similar edifice, the property of the next door neighbor. This also opens upon a three-foot wide court running around the corner of the aforesaid neighbor's dwelling The little 3x12 back yard we are describing is bounded on one end by the one-story kitchen, and on the other end and the two sides by two-story buildings. The house has two windows in each of its two stories, and the kitchen has a door—all opening into this cesspool yard. The two lower windows of course belong to the dining-room. The exhalations from the privy are exceedingly offensive, as might be supposed. They are shut off from lateral air-currents, and find their way in large quantity into the kitchen, dining-room and chambers. Indeed, there is little other chance of escape for them. The whole arrangement looks as though it might have been planned as a hot-bed of zymotic disease. Let us see with what success.

In August, 1883, a young blacksmith came to board in the house. He was soon siezed with typhoid fever. His physician immediately sent him to the Episcopal hospital, whence he returned recovered. Nearly a year later, in May or June, 1884, another new boarder, a huckster, was attacked with the same malady. He was at once transferred to the hospital, whence he returned safe and sound in August. (During this summer the cess-pool was "cleaned," *i. e.*, cleaned after the manner and methods in such cases usually made and provided. In other words, it was nearly emptied of its contents.) Soon after the recovery of the second case, a third new boarder, a street car conductor, became ill with typhoid fever, went to the hospital, and recovered. Here were three cases in about sixteen months, and it would seem that their prompt removal to the hospital, and the intervals that elapsed between the cases, ought to preclude the probability that one transmitted the disease to the others, though it is undeniable that the typhoid germ may maintain its virulence for a long period.

The fourth victim was not a boarder, but a visitor. After spending at the house the Christmas holidays of 1884, he returned to his distant country home on the mountain side, where he soon sickened with typhoid fever. His dejecta, which were unusually abundant, found their way into a little stream which flowed past the house, and thence

into a supply reservoir below. For the subsequent history, ask poor plague-stricken Plymouth. When Philadelphia sent to the hapless inhabitants of that pest-ridden town money and medicines, and food and nurses and physicians, it was not charity; it was but a small instalment on an immense debt. Had there been no defective cess-pool in Philadelphia, there would have been no typhoid fever epidemic in Plymouth.

In her typhoid fever mortality, this city has a bad record. She also has cess-pools; the ground on which she stands is fairly honey-combed with them. They poison the soil beneath our homes; they pollute the air we breathe; they contaminate the water we drink and the food we eat; they hurl disease and death in their most loathsome forms into our circle of loved ones. The privy-vault, even at its very best, in any city or town, and even when very near a rural dwelling, is a dangerous, insufferable, abominable nuisance. There are degraded savage tribes who keep in their huts for long months the putrefying bodies of their dead; but how does it accord with our ideas of the intelligence, the taste, the refinement of this age, that the great mass of our people keep, within a few feet of their hearthstones, whole tons and tons of festering, reeking rottenness? Whatever we may do with the sewers, let us—in the name of decency and cleanliness and health and life—let us banish the cess pool.

The sanitary significance of typhoid fever is not overwork; it is filth. The disease does not essentially mean the result of the wear and tear, the hurry and worry of life; it means filth—filth every time—noisome, reeking, disgusting filth. And one of the practical questions of this age is whether we physicians shall have the boldness—and true physicians are always bold—to stand up in the presence of our stricken patients and tell them so, in order that safety may be secured to others.

Our city board of health has adopted a rule requiring that all cases of typhoid fever shall be reported as are other infectious diseases. These reports should be followed up in every case by a thorough and complete expert examination of the house, or, if necessary, the school room, store or workshop where the victim may have contracted the disease. But to do this, the Board must have money.

VII. The Progress of Sanitary Science in the State of Mississippi During the Past Ten Years.

By W. F. HYER, M. D., *of Holly Springs, Miss.*,
Member Mississippi State Board of Health.

A paper concerning the progress of sanitary science in the State of Mississippi may appear irrelevant on the present occasion; but this country, although so vast in extent, is so closely knit together by the great arteries of trade and travel which link one border with another that no epidemic of contagious or infectious disease derived from a foreign country can gain a foothold in our borders without endangering the health and welfare of every city and every State in our common country.

It is not beyond the memory of man when the yellow fever ravaged the city of Philadelphia, and although a better system of quarantine and sanitary regulations renders your city less liable to infection than in former days, yet under favorable circumstances you have no guarantee that you may not again become victims to the yellow plague.

The main defense of your city against cholera and yellow fever lies in the strict enforcement of your maritime quarantine laws, for should the path of an epidemic approach you from the interior it would almost be a matter of impossibility, considering the many avenues of travel and commerce connecting you with the back country and other seaports to provide a successful and efficient quarantine without establishing an absolute policy of non-intercourse with neighboring cities and localities, unless your State Board of Health should be amply endowed with both funds and authority to enable them to take most efficient measures to intelligently guard every avenue of approach to your borders. A policy of non-intercourse with neighboring States would not be more disastrous to your commercial interests than would the presence of an epidemic of infectious or contagious disease to the lives of your communities; and it therefore behooves your State Board of Health, in conjunction with your State Medical Association, to make every legitimate effort to bend the minds of your Legislature to the importance of the interests at stake, and convince them of the necessity of arming your State Board with sufficient authority and funds to enable them to meet any emergency. It is not right that you should be held responsible, unless your hands be strengthened. Yet should disaster ensue to your people from epidemic disease, the responsibility would be laid on your shoulders. None better than myself know the difficulties that lie in the way of obtaining legislative action in the line of sanitation, and none realize better the ease with which such action may be obtained when proper steps are taken toward that end. The great mistake that is usually made in that direction by those having sanitary legislation at heart is in applying to members

of the Legislature *after* they have been elected and met in an organized body. For six years the Medical Association of the State of Mississippi annually approached the Legislature with their bills and memorials *after* their organization, and for six years their efforts were *nil;* for there is no person in the broad earth who is more filled with self-importance than he who has been elected to represent the dear people in the councils of state.

Our association finally hit upon the happy idea of approaching the embryo statesman before he is fully fledged; while he feels that he is only a small potato and few in a hill; while he is endeavoring to win friends favorable to his advancement; and experience teaches that if you make approaches at that time he readily falls a victim to your wiles. Enlist the doctors of your State in an effort for sanitary reform; induce them to demand pledges from candidates for legislative honors in advance of their election, and the pledges will be given and kept, and you will be placed on the high road to success and in a position to do honor to them who granted you authority and power. After noting then what power you have to protect yourselves, another subject of interesting inquiry arises when we consider the fact that the Asiatic cholera has again made its appearance in Spain, and that the yellow fever is again epidemic in South American ports, whether in the problem of how to prevent a spread of these epidemic diseases into the interior of the United States, should they gain a foothold in in our ports of entry, any factors are now present which were absent in 1878, and previous years. At that time when an epidemic disease made its appearance in New Orleans, all means of resistance had been utilized and the disease was free to spread itself along lines of travel, without any effort being made to stay it. The inhabitants of centers of population in the interior bowed their heads to the impending calamity with the indifference which characterizes the conduct of the eastern fatalist. We desire in this paper to call attention to the spirit of enlightenment which has come over the people of the South in this as in other matters, not only in Mississippi, but in all the other States adjacent to and connected with the Gulf of Mexico by paths of commerce and trade; and we can perhaps give a fair illustration of the present condition of affairs in all this region by describing the gradual but sure progress of the State of Mississippi in the line of sanitary education.

A history of the advance of sanitary science in the State of Mississippi during the last ten years is, to a great extent, that of the adjacent States of Tennessee and Louisiana during the same period. Sanitation is a result of civilization, of first importance in centres of dense popu- yet tardily considered and with difficulty sustained among sparsely settled rural communities. The State of Mississippi having no minerals within her borders, no manufactures of importance, with no large centers of population, is essentially an agricultural State, and therefore, to a certain extent, free from unsanitary conditions, which in

other localities give impetus and importance to the strict consideration of sanitary rules and conditions. Ten years ago the medical profession and the authorities of Mississippi were as profoundly indifferent to the operation of sanitary laws as were the people of Pompeii and Herculaneum to the eruptions of Vesuvius at any period preceding the great calamity which overwhelmed them.

At that time we relied upon the inefficient quarantine laws of Louisiana as they were operated in New Orleans, and of the State of Tennessee and city of Memphis, to protect us from the visitation of epidemics from foreign sources; for while the law of the State provided for the appointment of Boards of Health by municipal and county authorities, the appointments were seldom made; and when they were, the officials appointed were without authority, pay, or influence.

In 1876 a committee of the Mississippi State Medical Association formulated a bill, and by memorial presented it to the State Legislature for enactment into law, which provided for the establishment of a State Board of Health, whose members should be selected by the State Medical Association and appointed by the Governor, and whose term of office should be six years, one-third retiring every two years. The bill further provided that the Governor should appoint upon the nomination of the State Board of Health a competent medical man as health officer of each county, whose salary should be fixed by the board of supervisors of the county, said salary not to exceed that of the county superintendent of public education. This bill, after being rendered almost inert by amendments, was passed by the Legislature and signed by the Governor. It, as passed, provided for no pay for for the services of the Board of Health or their necessary expenses. Neither was any fund placed at their disposal for quarantine or sanitary purposes, nor was any authority granted them except to write papers on sanitary subjects, to be printed in their annual report to the Legislature at the expense of the State. Under these embarrasing circumstances the Board of Health annually spread their storm signals throughout the State, and the State Medical Association kept things hot in the legislative halls through their memorials and committees. No progress however seemed to be made in instructing the average legislative mind as to our sanitary necessities until the fatal and widespread epidemic of yellow fever of 1878 broke upon the people with all the suddeness and power of a western cyclone, destroying thousands of lives, bankrupting our most prosperous merchants, and carrying ruin to almost every industry, and terror into almost every household. Then it was that the inquiry was instituted throughout the State as to why the warnings and promptings of the organized medical profession had been spurned and disregarded, and it awakened the Solons of the State to the nature of their responsibilities, which resulted in the enactment of a statute giving the State Board of Health, ample power and ample funds to take such measures as they might deem

necessary to prevent further calamities from that direction. Not only was a valuable lesson taught the law-makers, but the Board of Health was convinced that the so-called quarantine system and health laws of Tennessee and Louisiana were a fraud and a delusion.

This law, however, was not enacted until 1880, the Legislature only meeting biennially. And during the year 1879, when the epidemic raged so virulently in Memphis and threatened a visitation to New Orleans, the Mississippi State Board, through pecuniary aid rendered it by the National Board of Health, was enabled to institute such measures as enabled us to keep the infection from our borders; and to the aid and assistance given us at that time is to be in a great measure attributed the unswerving loyalty and friendship rendered the National Board in its hour of adversity by the State Board of Health and Medical Association of the State of Mississippi.

After the epidemic of 1879, a spirit of antagonism displayed itself on the part of the Louisana State Board of Health as against the National Board, and a contest ensued between them, in which the boards of health, both State and municipal, in the Mississippi Valley, as a general thing arrayed themselves with the National Board on account of the fact that a belief was prevalent that the State Board of Louisiana was disposed to conduct their quarantine with an eye more to their trade with tropical ports, than to the sanitary interests of the people of the Mississippi Valley. This belief was intensified in the struggle by the National Board to make Ship Island a quarantine station rather than the Mississippi river station below New Orleans, for to this proposition the Louisiana Board made most strenuous opposition. The result of the contest was that the National Board of Health was shorn of its powers by the cutting off by Congress of its appropriation, leaving it in the condition of Samson after Delilah had made a raid upon his locks.

When the Boards of Health of the valley realized that their former friend and stay was powerless for further good, a feeling of uneasiness prevailed which resulted in the organization of the Sanitary Council of the Mississippi Valley, which was compesed of representatives of State and municipal boards of health, and representatives of railroad corporations and any other organized body interested in the prevention of the spread of epidemic disease, who took sufficient interest in the matter to send representatives. The conception and organization of this powerful body, of which the Mississippi State Board was a component, was to a great extent due to the earnest and untiring efforts of Dr. Jno. H. Rauch, the accomplished secretary of the Illinois State Board of Health. This body, sustained by an earnest public sentiment, had sufficient financial backing to enable it to fill the place made vacant by the retirement from active life of the paralyzed National Board, and during the period of its active life, the people rested secure in a consciousness of its power and ability to prevent the in-

troduction and spread of epidemic disease into the interior States. The feeling of distrust of the Louisiana State Board and want of harmony between it and the Boards of the interior has happily passed away under the able abministration of Dr. Joseph Holt, who by his wise and conservative course has won the confidence of all interested in sanitary matters. During the regimè of the Sanitary Council of the Mississippi Valley, the efficiency of the Mississippi State Board of Health was considered an important factor of the problem of how to prevent the spread of epidemic disease into the interior, should it gain a foot-hold in New Orleans; for all the railroads leaving New Orleans on the east side of the Mississippi river traversed the State of Mississippi, and on the borders of that State was the first defensive line against its further progress. That the Sanitary Council placed confidence in the diligence of the Mississippi State Board is a matter of history. Whether or not that confidence was deserved the future must determine, since happily the occasion for demonstration has not yet arrived, with the exception of the fact that during the years 1882, '83 and 84, there were between seventy-five and eighty outbreaks of epidemic small-pox in different parts of the State, one of which was in Vicksburg and one in McComb City, two of the most crowded centers of population, the others mostly in the thickly-settled negro centers in the Mississippi river bottoms. In none of these instances did the disease spread outside of the limit confining it when taken charge of by the board, and in no case could the infection in one place be traced to another in the State, but all were started from centers of infection imported from other States.

I have been actuated to discuss the subject matter of this paper as exemplified in the organization and present efficiency of the Mississippi State Board of Health, from the fact that with the presence of the cholera in Europe and yellow fever in the tropics, the eyes of the country are necessarily turned upon the city of New Orleans as a port of entry through which foreign epidemic disease may obtain a foothold in the United States, and in that case the safety of the interior depends largely upon the efficiency and potency of the Mississippi State Board, for, as before intimated, all the lines of communication of New Orleans with the interior on the east of the Mississippi river penetrate initially the State of Mississippi. Texas and Arkansas guard the lines of communication with the interior on the west side of the river. Mississippi guards the Mississippi river, with the State of Tennessee and city of Memphis in reserve.

The State Board of Tennessee and the Municipal Board of Health of Memphis are veterans in sanitary warfare, and will give a good account of themselves when the occasion requires. It is a matter of interest then to know on what means of protection the interior States may rely if epidemic disease should gain a foothold in the great southern port of entry; and if energy, rare topographical advantages,

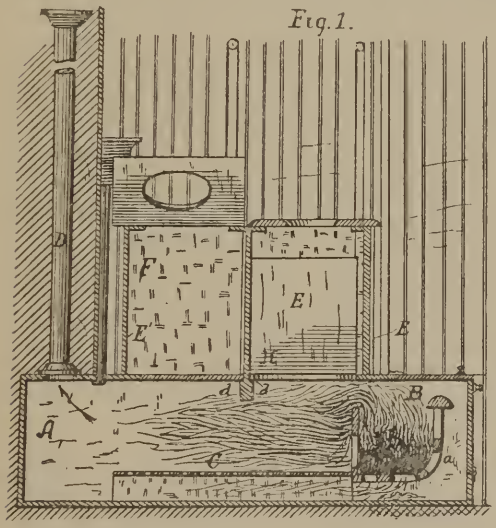
complete authority and an abundant appropriation can avail, the risk of the spread of epidemic disease through the territory of Mississippi is hereafter reduced to a minimum.

VIII. The Disposal of Human Excreta by Fire.

By W. S. Ross, M. D., *of Madisonville Kentucky.*

"Figure 1 represents a longitudinal view of the apparatus and attachments, and figure 2 is a traverse view of the same." The combination consists, first, in an attachment for a privy, a horizontal metallic casing constituting the depository for the fecal matter, provided with the hinged lids and fire chamber; second, the attachment for a privy, consisting of the horizontal metallic casing with the perforated false bottom *C*, bridge-wall *B*, and grate bars *C*, arranged in about the same horizontal plane with the hinged lids *E* and door communicating with the grate-surface; third, the combination of the horizontal casing *A* with the perforated false bottom *C*, grate-bars *A*, bridge-wall *B*, hinged lids *E*, privy box, with hinged seats and the connecting means."

Fig. 1.



"The seat-boards should be made double, the grain of the wood reversed, and glued together; this will prevent warping."

"The hinged lids being connected by a metallic cord, and the furnace lids *E* being heavier than the seats, they work automatically. The furnace lids being heavier than the seat, as soon as the weight of the body is removed from the seat the furnace closes, and so remains except when

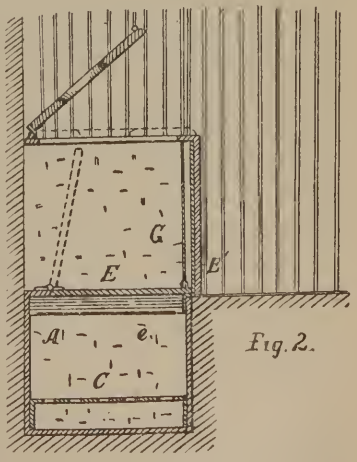


Fig. 2.

being used; the odor is thus confined to the furnace, and forced to escape through the flue or draft-pipe and into the air above the building. The front (*G*) of the privy box is lined with metal, preferably of sheet copper, which extends down beyond the line of the casing a short distance into the depository, and is intended to carry down the liquid matter that may be impinged against it."

IX. Physic-Tippling and Medicine-Bibbing—A Warning Against Intemperance in the Use of Drugs.

By FRANK WOODBURY, M. D.,

Of Philadelphia, Professor of Therapeutics, Materia Medica and Clinical Medicine in the Medico-Chirurgical College.

Sanitary science differs from the ordinary practice of medicine chiefly in regard to the subjects with which it deals. Curative medicine has to do with the individual, and considers everything from the standpoint of the individual. Sanitary science, on the contrary, cares less for the individual than for the type; it is concerned with the welfare, mental, moral and physical, of the race, and the condition of the community in relation with civilization; it is chiefly interested in the production of that large and healthy population which is a nation's true source of wealth and hope of permanent prosperity. It is very deeply interested in the habits of individuals on account of the powerful influence for good or evil which they may exert, by heredity, upon the generations which are to follow.

Man has reached the present high state of development, which he enjoys in the most highly cultivated nations of the earth, by slow and painful progress, committing many mistakes, but steadily rising out of the ashes of former self to nobler and better life. Accompanying this high state of development are influences which constantly tend to cause reversion to a lower type. It is especially against such agencies producing deterioration of the race that sanitary science wages unremitting warfare.

Among the habits which certainly cause physical degradation is the constant use of narcotic and so-called stimulant drugs. With the great problem of intemperance in alcoholic liquors, society is now engaged; and as attention has been so constantly directed towards it, I need not further concern myself with it at present. Nor will I discuss the evil effects of tobacco upon the human frame; with these you are familiar, or at least know where to find abundant information if you desire it.

The object of this paper is to direct public attention to a habit which has insidiously crept into our life as a people, and which in my estimation has attained sufficient proportions to warrant consideration at such a conference as this.

Not long ago, while in a Chestnut street drug store, I observed a richly-dressed but poorly nourished woman approach the soda water fountain and ask for a glass of soda water containing bromide of potassium. She was evidently nervous, but the thought occurred to my mind that the natural way to overcome nervousness (or nervelessness) would have been to alter the habits of life which produced the morbid condition, rather than to overwhelm what little vitality might be left in her body with nerve sedatives. Inquiring of the drug clerk, I found that it was a common habit for customers to ask for medicinal substances in soda water. Leaving out of question the possible ill effects of the soda water itself, I found that potassium bromide, aromatic spirits of ammonia, soda mint, sodium bicarbonate, acid phosphate, tinctures and elixirs, were in very frequent demand. In another drug store, I saw a precription calling for a mixture containing chloral, posted up behind the counter. I inquired why it was placed there, and was informed that it was merely for convenience, as it had been refilled over a hundred times. Here was a case in which a patient having received a prescription for temporary use, had continued taking it upon his own responsibility, certainly, in my opinion, reducing himself to a physical wreck and inviting early death. I have been informed by druggists that should a physician prescribe a mixture containing alcohol, if it be at all palatable, the order to re fill it will come again and again, and yet again.

We all know how the opium habit is formed—few there are who realize what a hold it has taken upon the people. The drinking of ether and similar anodyne mixtures is not uncommon, and too often prepares the way for indulgence in grosser forms of intemperance.

This is not intended to be a statistical paper, or I would proceed to show by figures how the demand for remedies, acting upon the nervous system particularly, has within comparatively few years experienced a large increase. The bromides only a few years ago were but little used; now it is estimated that at least 200 tons are used every year in this country alone. Of chloral hydrate, introduced in 1869 by Liebreich, it was said that in America and England alone, a ton was consumed each day, eight years ago; it cannot be less now. Nor will I speak of the vast amounts of the preparations of cinchona, of opium and of mercury; or of the alkalies, iodides, and digestive ferments, which flow in a steady current from the stills of our manufacturing pharmacists down the throats of a confiding community.

But this, although sufficiently large, is a comparatively small part of the medication of the masses. Try to form an idea of the capital invested, and the fortunes made in the sales of patent medicines. Does any one contend that all this supply is needed to meet a natural demand? Why is it, the sanitarian asks, that man, the paragon of animals, requires so much more medicine to keep him alive than his more or less domesticated brethren? Why is it that civilized man in

the nineteenth century, consumes larger quantities of narcotic drugs —morphine, chloral, bromides, ether and chloroform—than his forefathers? What is to be the result upon the population in the twentieth century? Can we not see abundant evidence of the bad effects of over-medication in the weakened digestion and impressionable nervous system, which have become almost universally recognized as characteristic of American life?

The anarchists the other day in Chicago, who wrecked a drug store and revelled in wine of colchicum, and paid the penalty for their indulgence with physical suffering and death, are but an exaggerated illustration of what is going on around us every day.

In saying this, I hope I will not be misunderstood. This is not a tirade against the use of medicine, but a warning against its too prevalent abuse. It is not a denunciation of doctors, but on the contrary it will be my endeavor to show that the taking of midicine—and especially the administration of medicine to young children—is a matter worthy of sober, serious consideration; and, as far as possible, should be undertaken only by competent medical advice.

Among the causes for the enormous drug trade in this country, is to be counted, undoubtedly, the over-crowding of the medical profession. Until within a few years there were practically no restrictions in this State upon the practice of medicine—the law did not require a doctor to be either a scholar or a gentleman. Thousands of half educated or entirely uneducated men, furnished with cheap diplomas, were set loose to prey upon the community; and drug stores sprung up at nearly every corner.

In addition to this free dispensaries were started in all our large cities, and the public systematically trained to ask for medicine as regularly and naturally as they do for their daily bread.

But this is not all. The patent medicine advertisements in the public prints warn us that hundreds of thousands of dollars are spent unnually in the effort to induce our fellow citizens to purchase and consume medicines which otherwise they would not buy. I do not mean to say that all proprietary medicines are necessarily worthless and injurious; but I do say that which I do know, that the greater part of the demand for them is artificial, fictitious, and is due to persistent advertising.

Another reason for the extraordinary demand for medicine is of a different kind, and has its roots in the minds of the people. We are impatient and illogical. We do those things which we should not do, and leave undone the things which we ought to have done. This is preëminently applicable to our eating. A large proportion of this community is suffering constantly from indigestion in some form or other. Does this lead men to carefully study their capacity for digestion of different articles of food? No; they prefer to keep on eating and drinking the very things which make them sick, and then call

upon the druggist for aid. The growth within a few years of the demand for digestive ferments is astonishing. Pepsin and pancreatine in various forms, constitute a large proportion of the daily sales of city druggists.

Let us stop for a moment to consider what the effect of artificial digestion must be. If the pepsin be introduced by the mouth our stomachs will naturally cease to secrete it, and consequently, according to physiological law, will lose the function. We have largely lost the use of our grinding teeth because our ancestors ceased to eat roots and to crack nuts, and took to boiling their meat and vegetables, and now it appears that we are fast losing our stomachs also. It has been said that were it not for the constant influx of fresh blood from the country, large cities would be depopulated in a few generations. This I believe is most true in those communities where the greatest amount of medicine is consumed. Our babies are fed with artificial foods because the defective vitality of the mothers forbids nursing them; when they suffer with indigestion and cry, they are drugged with soothing syrup and paregoric; if they venture to cough they are dosed with squills and antimony; and in between the doses they are given castor oil, worm-lozenges, gingerbread, catnip-tea, soda-mint and calomel, until they are large enough to drag their sickly little bodies to school; then they have cod liver oil and iron and quinine to keep them going; and when nature kindly gives them a fever in order to give them some rest in bed, they are dosed *ad nauseam* by officious friends and attendants. In later life their weak physical frames and poor digestion are scarcely equal to the demands of modern life, and there is constant resort to the whisky bottle to supply a delusive feeling of strength and vigor. There is a sober truth underlying the statement of the toper, who gave as his excuse for drinking, that "he was brought up on the bottle and never got weaned." Is it any wonder that in civilized communities men scarcely live out half their term of life; or that so many dying can repeat the words of the Patriarch, "Few and evil have the days of my life been?" One-fourth of all the children born in civilized countries die before they reach the fifth year of age, and the proportion is even greater in large cities. Among the recognized causes of weakened vitality in children I wish to place the abuse by parents of medicines acting upon the nervous system, and especially alcohol, tobacco, opium, chloral and the bromides.

It is not time to look for some improvement in this regard? A great change has taken place in our views of disease within comparatively few years. Recent studies into the causation of diseases has shown us that they are largely external in their origin, and the symptoms which were heretofore regarded as the disease itself, are in reality only evidences of the reaction of the system against the

disease. Modern medicine, therefore, instead of combating the symptoms, aims at the cause of the malady, and endeavors to aid nature and not to oppose her. We now know that morbid processes are essentially conservative, and that inflammation instead of being a condition to be dreaded and combatted, is nature's reaction against an irritant; it is not the cause but the effect of disease.

As sanitarians, we would teach the public that they should bear with patience the ills that flesh is heir to; that disease is very largely affected by mental states, and that physical troubles are made greater by thinking about them. Medicine is a two-edged sword, and, if capable of doing good, is also capable of doing harm; unfortunately, the harm is not limited to the individual, but affects the future of the race. Physic-tippling and medicine-bibbing is simply a form of intemperance. The taking of medicine is a matter of grave importance. and should only be done by competent medical advice, and should not be continued longer than the emergency demands.

I would make an especial plea for the children, who are daily sacrificed to the mania for medicine-giving. I was called not long ago to see a delicate little girl, seven years of age, whose ignorant and brutal father had administered eleven cathartic pills. Such instances are not rare in the experience of physicians practicing in the cities. Deaths are constantly occurring from the administration of nostrums to young children: how much permanent ill health is produced we may only surmise. We have laws regulating the sale of certain well-known poisons, but no law regulating the manufacture and sale of so-called patent medicines—containing colchicum, opium, alcohol, digitalis, antimony and a legion of other poisonous drugs—which the public consume in immense quantities to the evident detriment of health.

In conclusion, for the purpose of checking this evil, I would recommend:

1. The examination of all proprietary medicines by a government or State commission of experts, which shall have power to permit the sale of such as are harmless or especially likely to prove serviceable, and to prohibit the sale of all which are liable to do injury, and particularly those which are found to be worthless and frauds upon the public. Such a commission was appointed by the Japanese government several years ago, and has been found to be of great service in that country.

2. The instruction of the public to properly estimate drugs, and to regard every unknown medical agent as dangerous and endowed with capacity for harm. Let them endeavor to escape the caustic criticism of a Molière upon those who "pour medicine about which they know little, into bodies about which they know less, in order to cure disease about which they know nothing at all."

X. Overwork and Sanitation in the Public Schools of Philadelphia, with Remarks on the Influence of Overwork in the Production of Nervous Diseases and Insanity.

By Charles K. Mills, M. D., *President of the American Neurological Association, etc.*

In 1860 I was admitted to the Boys' Central High School from a school in the outskirts of Philadelphia. the first pupil that had ever been sent from this particular school. For four years, except during a few weeks in 1862 and 1863, when with other boys of the school, and some of its teachers, I was doing military duty on the Maryland border, I was a pupil in the high school. Later, I passed two to three years in teaching in Philadelphia schools.

For many years most of my time has been spent at medical work; but a Philadelphia physician is thrown much in contact with teachers, pupils, and the parents of pupils; and it has always been of interest to me to watch the effects of the educational methods in vogue in this city upon the health, both of pupils and teachers.

Taking up the question of overwork and sanitation in Philadelphia public schools, I can only deal in the most general manner with it in the brief time at my disposal. The subject can only be touched upon. It embraces matters which would require for their full consideration many hours and many pages. My object is, simply, to call attention from the standpoint of a physician, who has also been an educator, to a few of the most important health topics connected with our public schools. Such a subject is surrounded with difficulties, although before attempting to discuss it I scarcely realized these difficulties to their full extent. It is worth repeating, trite though the saying be, that education is the greatest problem which we are called to solve. Every intelligent member of the community can, however, if he chooses, do something to advance and spread knowledge with reference to this important question.

I shall first give the results of some personal investigations into the present status of Philadelphia public schools.

During the progress of my inquiries, a gentleman connected with the public school system asked, "Why are we so much disturbed here about overwork? We hear of no such agitation abroad, where we know, as in Germany for instance, great intellectual results are obtained." This is a mistake. Much attention has been paid abroad in recent years to this subject. In Denmark, Dr. Hertel, the municipal medical officer of Copenhagen, conducted a year or two ago, a series of investigations in the high schools of Copenhagen, and has published the results of his work in an interesting book,* which has been re-

*Overpressure in High Schools in Denmark, by Dr. H. Hertel. Translated from the French by C. Godfrey Sörenson, with introduction by J. Crichton-Browne, M. D., LL. D., F. R. S. London: Macmillan & Co., 1885.

cently translated. This book contains reference to similar work done in Sweden, Germany and elsewhere. In London, some two years since Dr. J. Crichton-Browne, a distinguished authority in mental diseases, and Lord Chancellor's Visitor in Lunacy, investigated a number of the elementary schools in London, and awakened a controversy in educational and government circles, the like of which has not been known for a long time.

Through the courtesy of Dr. Browne I have received the official documents† bearing upon this investigation, which are of great interest and value.

I made a limited but systematic personal investigation of certain schools, taking for this purpose two contrasting sections (so far as the social and home advantages of the children were concerned), and the girls' normal school and the boys' high school. I also made inquiries, either personally or by letter, of many parents, of members of the board of education, of the superintendent and assistant superintendent of the public schools, of a large number of teachers, chiefly principals of the grammar, secondary and primary schools, and of professors and teachers in the high school and normal school.

On beginning my inquiries, I found at once that the public school system of Philadelphia was in a state of confusion. At one end of the system, the primary and secondary schools were working under a new graded method introduced by the superintendent, Mr. James MacAlister; at the other, the high and normal schools were at work under an old method, graded it might be, but on entirely different principles; and between these two extremes were the grammar schools for girls, in which the pupils, under high pressure, were working for the final test of a severe competitive examination to admit them to the normal school, and the grammar schools for boys, in which a quota method of promotion to the high school had taken the place of competitive examinations.

A circular having certain queries printed upon it was prepared. I purposely avoided providing a place for the names of scholars, in order that the pupils answering should not be identified. I am sorry to say that they were very generally identified, although not by me.

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† Elementary Schools (Dr. Crichton-Browne's Report.) Return to Two Addresses of the Honorable the House of Commons, dated 19th June, and 31st July, 1884;—for,

(Address 19th June, 1884.)

"Copy of Report of Dr. Crichton-Browne to the Education Department upon the Alleged Overpressure of Work in Public Elementary Schools." (Lord George Hamilton.)

(Address 31st July, 1884.)

"Copy of Mr. Fitch's Memorandum relating to Dr. Crichton-Browne's Report in continuation of Parliamentary Paper, No. 293, of the present session." (Mr. Mundella.)

Ordered by the House of Commons, to be printed, 24th July and 4th August, 1884. London: Printed by Henry Hansard & Son, Printers to the House of Commons.

The following were the questions included in the circular: Class or division? Age? Number and names of studies? Number of hours of school work? Preparation? Recitation? Number of hours of home work in preparing lessons? Number of hours of sleep? Whether or not the pupil suffered from headache, nervousness, dyspepsia, eye troubles, or any form of ill health, that could be fairly said to be due to school studies?

These circulars, with the permission of the Board of Education and the directors of the schools, were distributed to the pupils, the objects of the questions were carefully stated, and the pupils were told to take the papers home and carefully answer after consultation with their parents.

In this way investigations were made in four grammar schools, two for girls and two for boys, and in the boys' central high school and the girls' normal school. I will give, in as condensed a manner as possible, the results with reference to home work, and the effects of school studies upon health. I have not adopted the averaging method in presenting these results with reference to home work, but one which I believe is better; that is, I have arranged the results so as to show how many children studied six hours or more, five, four, three or two hours, or one hour, or more or less than one hour. In an averaging method, a few may cause the average to be high or low. Where four, three, two hours or one hour are spoken, the report was as to this time or more.

In one girls' grammar school the total number which reported was 343. The report was as follows: Studying at home six hours, none; five hours or more, 1; four hours, 1; three hours, 33, two hours, 132; one hour, 154; less than one hour, 22

One hundred and seventy-nine (179) out of the 343 reported that they suffered in some way from ill-health as the result of their school studies, the detailed report as to the form of ill-health being as follows: Headache, 124; nervousness, 57; dyspepsia, 3; eye troubles, 54; miscellaneous ailments, 5. This made a total of 243, more than one complaint being reported by 64.

In another girls' grammar school, the total number reported was 240. The report was as follows: Studying at home six hours, none; four hours or more, 1; three hours, 11; two hours, 48; one hour, 144; less than one hour, 35; not reporting. 1.

Out of 240, no less than 139 reported that they suffered from ill-health as the result of their school studies, the detailed report as to the form of ill health being as follows: Headache, 107; nervousness, 38; dyspepsia, 3; eye troubles, 33; miscellaneous ailments, 2. This made a total of 183, more than one complaint being reported by 44.

In one boys' grammar school, the total number which was reported was 169. The report was as follows: Studying at home six hours,

none; four hours or more, 2; three hours or more, 7; two hours, 25; one hour, 44; less than one hour, 79; not reporting. 12.

Seventy (70) out of the 169 reported that they suffered in some way from ill-health as the result of their school studies, the detailed report as to the form of ill-health being as follows: Headache, 45; nervousness, 10; dyspepsia. 3; eye troubles, 24; miscellaneous ailments, 3. This made a total of 85, more than one complaint being reported by 15.

In another boys' grammar school, the total number which was reported was 188. The report was as follows: Studying at home four hours or more, none; three hours, 1; two hours, 18; one hour, 126; less than one hour; 42; not reporting, 1.

Fifty-three (53) out of the 188 reported that in some way they suffered from ill-health as the result of their school studies, the detailed report as to the form of ill-health being us follows: Headache, 29; nervousness, 10; dyspepsia, 3; eye troubles, 20. This made a total of 62, more than one complaint being reported by 9.

In the girls' normal school, the total number which reported was 572. The report was as follows: Studying at home six hours or more, 2; five hours, 14; four hours, 36; three hours, 134; two hours, 235; one hour, 120; less than one hour, 31.

Two hundred and sixty-seven (267) out of the 572 reported that in some way they suffered from ill-health as the result of their school studies, the detailed report as to the form of ill-health being as follows: Headache, 177; nervousness, 70; dyspepsia, 12; eye troubles, 82; miscellaneous ailments, 30. This made a total of 371, more than one complaint being reported by 104.

In the boys' central high school, the total number which reported was 123. The report was as follows: Studying at home six hours or more, 1; five hours, 6; four hours, 15; three hours, 39; two hours, 40; one hour, 22.

Out of the 123, only 19 reported that they suffered from ill-health as the result of their school studies, the detailed report as to the form of ill-health being as follows: Headache, 9; nervousness, 3; dyspepsia, 4; eye trouble, 5; miscellaneous ailments, 1. This made a total of 22, more than one complaint being reported by 3.

The results, with reference to home work and ill health, show some overwork in the public schools of Philadelphia, but great improvements have taken place in recent years. Where pupils now report two, three or four hours of home work, I well remember that, twenty or more years since, five, six, seven and even eight hours were frequently spent at work out of school. A good friend asserted to me the other day that the school children of Philadelphia were suffering from underwork. This may be the case in special schools—it may be the case in certain sections—but I do not believe that any such general statement could be substantiated. The children are suffering, in

not a few places, from bad methods of work rather than from genuine overwork, because one grade of the school system does not dove-tail with others—the gaps are too great, the changes from one level of the system to another too abrupt. I believe that overwork still exists in the public schools of Philadelphia—less than formerly and decreasing, but sufficient to call loudly for remedy. I make this assertion with diffidence, knowing that it may be antagonized, and feeling that possibly others may have better means than myself of knowing; but still the opinion is one reached as the result of experience and investigation. The overwork is most marked in the higher grades of grammar schools, more particularly in the girls' grammar schools and in the girls' normal school.

In the primary and secondary grades there should be no home work. Both the teaching and the studying should all be done in school. In the grammar grades home work, to a certain extent, should be allowed; but this should not exceed, in the lower grammar grade, one hour a day; that is, the compulsory home work should not be more than the average child could get through with in one hour. In the higher grades it should not be more than one hour and a half, or, at the most, two hours. Recall the figures just given and it will be seen that, in some of the schools, three hours or more, and often two hours or more, were spent in home study. When you come to the girls' normal school and the boys' high school, the compulsory home work certainly should not exceed what the average pupil of these schools could do in two hours, or, at most, in two and a half hours. One professor in the high school, a conservative man of long experience, said to me that he believed that only three studies a day should be required to be done at home, and that these should be of such a character as not to require the average boy to devote more than half an hour to each of them. Far different is the state of affairs shown by the above reports.

Concerning the secondary schools now working under the "new system," as it is called, the system inaugurated by the praiseworthy efforts of Mr. MacAlister, I shall have only a few words to say. The method does not insist on any home work, in fact insists that there shall be none in the secondary grades. For this reason, at first I paid but little attention to the question of home work in the secondary grades. My attention was called to the subject, however, by a parent claiming that his child was overworked in one of the secondary schools. I went into a secondary where at the time by actual count forty-eight boys were present. I asked how many studied their lessons at home, and all but three held up their hands. In order to encourage them to tell the truth, I said, "You know, boys, that you should not study at home." The teacher said to me nervously, "Don't say that; you will spoil them." Of course I did not say anything further. They were certainly expected to study at home. In another secondary school I

asked the teacher whether any of the pupils studied at home. She said practically they all did, "Why is this?" I asked, "are the pupils not expected to get through their work in school?" "I suppose that is the idea," she replied, "but examination is coming round, and it is by that we are measured." I said "Yes, but the examinations are in your own hands." She replied that the five highest and the five lowest papers had to be sent to the superintendent.

I am not inclined to attack any individual or any particular school, even schools in which there seem to be, from my own standpoint, defects and shortcomings. Why does the ambitious principal of a girls' grammar school stay hour after hour during school, working during recess and after school hours, taking home her papers, and at times, I believe, her pupils as well? It is that she may sustain her reputation in her own section or school. She feels that she is obliged at almost any cost to have a certain average number of pupils admitted from her highest grade to the normal school. In individual cases teachers may be at fault, but on the whole the difficulty is in the system It is only by having a system thoroughly graded from bottom to top, from the primary to the normal and high schools, that we can hope to get rid of defects and shortcomings. This has been pointed out by Mr. MacAlister in his report to the board of education on the revision of the grammar school course of instruction. I believe that it cannot be contradicted, that in the grammar schools of Philadelphia, as at present conducted, the pupils are required to do in from one and a half to two years what the school children of Boston, New York and some other cities are allowed four years to accomplish. Philadelphians may be heroes, the descendants of heroes, and their children heroes in the making; but brave and strong as we are, we cannot hope that our children shall make the same conquests in two and a half years that require four years for the children of Boston and New York.

In some schools fewer subjects should be taught. I believe this to be the case, to some extent at least, in the boys' high school, in the girls' normal school, and in some of the grammar grades, as will be shown by a rapid glance at the following list of the studies pursued in some of the higher schools:

The Boys' Central High School: Logic, composition, elocution, English literature, astronomy, uranography, calculus, analytical geometry, trigonometry, geometry, Latin, algebra, mental science, German, political economy, physics, chemistry, natural history, physical geography, anatomy, physiology, mensuration, higher arithmetic, mechanical and engineering drawing, shades and shadows, orthographic projection, linear perspective.

Girls' Normal School: Geology, physiology, botany, mythology, physical geography, music, logic, rhetoric, composition, chemistry, natural philosophy, astronomy, moral science, literature, Constitution

of the United States, free-hand drawing, sewing, drawing, trigonometry, arithmetic, algebra, geometry, theory and practice of teaching, physical exercises, methods of teaching, orthography, elocution, reading, penmanship, general history, literature and etymology.

Girls' Grammar School, Senior Class: Reading, composition, grammar and parsing, etymology, spelling, arithmetic, mensuration, algebra, physical geography, English history, Constitution of the United States, literature, physiology, drawing, writing and sewing.

Girls' Grammar School, B and A Grades: Reading, composition, grammar and parsing, etymology, spelling, arithmetic, geography, history of the United States, drawing, writing, object lessons and oral instruction, sewing.

In the boys' grammar schools the list of studies is similar in general scope.

Certainly a few of these subjects might either be dispensed with, or the amount of time given to them reduced. Far too much time is devoted to some subjects, like etymology, for instance, which return large averages but do not call out and develop the thinking power of the children.

With reference to the number of hours of school work but little of value was learned. Most of the time in school—in not a few cases all of it—was occupied with recitations. Even when a certain number of hours were supposed to be set apart for preparation in school, this time was usually not strictly used for this purpose.

Judging from the answers to the printed queries, the pupils of the Philadelphia public schools do not suffer much from want of sleep. The returns indicate an average of eight to nine hours' sleep for the large majority of those reporting. I was unable, however, in my limited time to obtain special details as to sleep. The hours reported doubtless in many cases indicated rather the time in bed than the actual amount of sleep. Particulars as to disturbed sleep, dreams, etc., were not obtained.

Dr. Crichton-Browne, in his investigations of the elementary schools of London, interrogated a large number of children with reference to sleeplessness. He found that the testimony of scores of children that they lay awake till midnight or one or two in the morning remained unshaken on cross examination. He tells us that arithmetic would appear to be the worst enemy of tired nature's sweet restorer, for one of the commonest explanations of sleeplessness given to him was "Please, sir, I can't get to sleep for thinking of my sums." One boy said that conscience kept him awake, by which it turned out that he meant a consuming feeling of remorse for not having passed his standard. Home lessons, he believed, were responsible for a good deal of sleeplessness. They keep up whatever over-pressure there may be in the school, worry the child who has to prepare them amid distractions and difficulties, and prevent that even subsidence of brain

activity which is the best prelude to a good night's rest. Out of 4,300 boys and girls examined as to the prevalence of sleeplessness, 1,668 cases of sleeplessness were reported, that is a percentage of 38.8. In one school of 381 boys he found 129 of them were sleep-talkers, and 28 were sleep-walkers. In a school of 432 girls he found 17 somnambulists, and in another school of 382 there were 20.

The answers to the question with reference to ill health attributable to school studies gave the following results:

Girls' grammar school, 124 cases of headache out of 343 reporting.

Girls' grammar school, 107 cases of headache out of 240 reporting.

Boys' grammar school, 45 cases of headache out of 169 reporting.

Boys' grammar school, 29 cases of headache out of 188 reporting.

Girls' normal school, 177 cases of headache out of 572 reporting.

Boys' high school, 9 cases of headache out of 123 reporting.

Girls' grammar school, 157 cases of nervousness out of 343 reporting.

Girls' grammar school, 38 cases of nervousness out of 240 reporting.

Boys' grammar school, 10 cases of nervousness out of 169 reporting.

Boys' grammar school, 10 cases of nervousness out of 188 reporting.

Girls' normal school, 70 cases of nervousness out of 572 reporting.

Boys' high school, 3 cases of nervousness out of 123 reporting.

A very small percentage reported as suffering from dyspepsia

Girls' grammar school, 54 cases of eye trouble out of 343 reporting.

Girls' grammar school, 33 cases of eye trouble out of 240 reporting.

Boys' grammar school, 24 cases of eye trouble out of 169 reporting.

Boys' grammar school, 20 cases of eye trouble out of 188 reporting.

Girls' normal school, 82, cases of eye trouble out of 572 reporting.

Boys' high school, 5 cases of eye trouble out of 123 reporting.

Let me be perfectly fair about this matter of ill-health reported as a result of school studies. The answers to this query are of course open to considerable criticism, but the method adopted is perhaps the best after all, to get at any results in a reasonable time. Crichton-Browne got answers by the holding up of hands, which was not as good a plan. I insisted that in answering this question the pupils should consult with their parents. The percentage of ill-health reported as due to school work should undoubtedly be diminished.

One teacher came to me and said that she thought the question as to ill-health quite unfair; that, for instance, a certain girl who had reported that she suffered from indigestion as the result of school work, had to her knowledge eaten a mince pie the day before. One young lady reported (I think that there is a vein of humor in this young lady,) that she suffered from indigestion and several other thing, but especially from freckles. A number of misunderstandings, or at

tempts to make misunderstandings, arose, but I believe that notwithstanding these, and the fact that many of the cases of ill-health ascribed to school work may have been due to other causes, a large percentage of the answers returned can be taken as of value. If we even diminish the returns by one-half, we still have a larger percentage of ailments than we should have under any school system. I did not attempt to get any details as to special forms of nervous disease due to school work. Under "nervousness" such affections as chorea, hysteria, neuralgia, etc., were reported. My object was to get at general facts and opinions. Among the acute nervous disorders likely to occur in childhood and youth as the result of mental overstrain, particularly that which prevails under a pernicious school system, are headache, neuralgias, general nervousness, sleeplessness, hydrocephalus, chorea, hysteria, hystero-epilepsy, insanity of pubescence, and temporary albuminuria. To this subject I have already called special attention in one of the Toner Lectures.*

The number of cases of headache reported is certainly very large. Much of it, I believe, was attributable to the school.

Crichton-Browne† speaks with reference to this question of headache in school children as follows: "In 1879 Dr. Treichler, of Bad Leuk-Bern, read to the German Society of Natural Historians and Physicians assembled at Baden-Baden, a paper in which he maintained, as a result of investigations at Darmstadt, Paris, and Neuenburg, that one-third of the pupils in public schools suffer from habitual headaches, which are becoming year by year more common amongst boys and girls of school age, and which are to be attributed to brain exhaustion caused by school work. Dr. Treichler's statements were received with general incredulity. In commenting upon them, the *Times* remarked that while we may reasonably hope that Dr. Treichler has overstated his case even as regards France and Germany, we may be quite sure that as regards this country there is no state of things at all parallel to that which he describes. Some inquiries which I myself instituted at that time led me to believe that he had exaggerated the evils which he deplored, but the more extended and minute inquiries which I have now been able to carry out have conducted me to a very different conclusion. Whatever may have been the case in 1879, it is now certain that more than one-third of the children attending Elementary schools in London suffer from habitual headache."

I have no statistics from perional observations with reference to hydrocephalus, but will quote here the remarks of Crichton-Browne‡

*Mental Overwork and Premature Disease among Public and Professional Men. Ninth Toner Lecture. Delivered March 19, 1884, and published by the Smithsonian Institution, January, 1885.

†Report on Elementary Schools.

‡Op. cit.

on this subject: "That hydrocephalus is sometimes brought on by excessive study in children of sickly or unsound constitutions is an accepted truth in medicine; and that the increase in the mortality which it occasions during education and post-education ages is in some measure to be attributed to enforced mental application, is, I think, rendered probable by the fact that the rate of increase has been decidedly higher during the last ten years, when education has been so largely extended, than it was in the previous ten years, when education was comparatively neglected. Any medical man will, I am persuaded, find in the statistics of hydrocephalus, to which, as I have said, he would in the first instance turn in any inquiry into the lethal effects of education and over-pressure, enough at any rate to create grave misgivings in his mind, and to convince him that there is need of watchfulness and further inquiry."

It has been my lot to have under observation a large number of cases of chorea occurring in the school children of Philadelphia, in many of which cases mental over-pressure seemed to be distinctly the exacting cause of the attack. Crichton-Browne, however, strange to say, did not find one case of this disorder in any school which he visited. He was told of cases which had arisen in school, but which had been immediately withdrawn. He met many cases of muscular eccentricity closely bordering on chorea. Out of 6,580 children he found 48 who exhibited peculiar movements, antics or grimaces, especially when agitated, or called upon to do anything. Dr. Allan McLane Hamilton, as the result of some investigations conducted in New York, found that 20 per cent., of young children in the public schools displayed choreic movements of greater or less severity. Crichton-Browne also made inquiries as to stammering, and found a comparatively large number of cases in the lower standards, the effect diminishing decidedly in the higher standards of the elementary school.

As I have said in another place,* the injurious effect of American school or college life in the production of hysteria is undoubted, and should be thoroughly appreciated. Our educational processes act both as predisposing and exciting causes of this disorder. Both in our private and public institutions, the conditions are frequently such as to lead to the production of hysteria or to confirm or intensify the hysterical temperament. In our large cities all physicians of considerable practice are called upon frequently to treat hysterical girls or boys.

Clarke has considered some of these questions, and particularly with reference to the physiological processes of menstruation, and its bearing on the inability of girls to maintain equally with boys the stress of such competition.

A form of insanity which has within recent years been studied with care by alienists, is known as Hebephrenia, or the insanity of pube-

*A System of Practical Medicine, by American Authors, vol. v. p. 218.

scence, an affection "characterized by mental enfeeblement, marked by a silly disposition, following a peliminary period of depression, which has the same tinge as, without the depth of, that characterizing melancholia, and which coincides with or follows the period of puberty."* It is found in subjects between the fifteenth and twenty-second year usually; and as a rule, the termination is unfavorable. Many of the patients pass into a condition of secondary degeneration, from which they never recover. Undoubtedly, our forcing methods of education have something to do with the production of this form of insanity in special cases. Where, particularly, any hereditary pre-disposition to to mental disease exist, the probability of mental over-pressure resulting in the development of insanity at puberty or adolescence, should always be borne in mind. "Puberty," says Clouston,† "is the first really dangerous period in the life of both sexes as regards insanity, but it is not nearly so dangerous as the period of adolescence, a few years afterwards, when the body as well as the organs of reproduction are more fully developed."

The question inevitably comes up of examinations, and the methods of promotion from one grade of school to another. The figures which I have given do not touch upon this important point, although I made many inquiries as to examination and promotion. The two, three or four hours of work daily during the school term is not the whole of the matter. At certain periods in some of the grammar and normal schools, the pupils have what are termed reviews for examination. During these reviews times the amount of home work is, on the average, double, so far as I could learn from the parents and the children. Sometimes a day of non-attendance at school occurs between two days of examination. On such occasions, many of the pupils study three or four hours of the first day after going home, the whole of the next day, and even on the third day before going to school.

I do not believe that you can have a school system without examinations. I do not believe that you can promote children from one grade to another without some standard of qualification. The standard should be so made, however, that the promoting could be done by the most natural and reasonable process. The question of "quota" methods and "competitive examinations" here comes in for decision. I find very broad difference of opinion among the members of the school system, teachers, controllers, superintendents, etc., on this point. One holds one view, a second has entirely different opinion, while a third has a somewhat diverse view. I can simply say that for the health and general welfare of the pupils, a modified quota method, under a perfected system, is what we need in this city. An absolute quota method does not work well. What is the result in the boys' high school? Here are some of the statistics of one of the classes—the

*Insanity, Its Classifications, Diagnosis and Treatment. By E. C. Spitzka, M. D.
†Clinical Lectures on Mental Diseases.

present class A—which I have obtained through the courtesy of Prof. Riché. They show the percentage of pupils which have left in the different classes. The whole number admitted was 133. Left in H, 13; in G, 26; in F, 33; in E, 22; in D, 5; in C, 4; in B, 3. This leaves 27 pupils out of the 133 who started in nearly four years ago, 106 having dropped by the wayside. Doubtless some of these pupils have left on account of financial, social or domestic reasons. Discounting these, I think a fair per cent. of them left because they were unprepared to grapple with the subjects presented to them. This is not necessarily the fault of the schools below. It is the fault of the system. As I have said, I believe in some form of the quota method when the system is perfected so that the normal and high schools and grammar schools will fit into each other properly. The pupils come to the high school and are admitted on a certain average, say 65. That does not express it all. A boy gains an average of 65, but he may have a cipher on some important branch, such as arithmetic. How is he thereafter to grapple with algebra, geometry, trigonometry, differential calculus and mathematical astronomy? The result is not so much actual overwork and break-down as it is depletion of the school, the pupils leaving to escape the strain. If the system was perfectly graded so that the time in each grade of the school was sufficient, and the pupils were brought up to certain standards carefully and naturally, examination with a minimum average required in every branch would be desirable.

One practical objection to the competitive examination system expressed to me by a number of principals of boys' grammar schools springs from the advantages which some schools have over others in numbers, surroundings, and home influence, so that admissions would be almost confined to them, the weaker sections being excluded, in large measure, from representation in higher schools.

A few years ago the system of seating, and of lighting with reference to seating, was extremely bad. This has been largely corrected, owing to the attention called to the subject by Mr. A. M. Spangler, of the board of education, and Dr. S. D. Risley, the distinguished ophthalmologist. Dr. Risley a few years ago made a series of investigations, which have been published,* into the condition of the eyes of the public school children of Philadelphia, which I believe resulted in great good. He called attention to the high percentage of school children suffering from weakness of sight of various kinds, and also discussed the cause of and remedies for the evil.

What are some of the remedies for the evils of overwork which we have thus been indicating? In the first place, so far as the rising gen-

* Weak Eyes in the Public Schools of Philadelphia. The Report of the Committee on Examination of the Eyes of the Children in the Public Schools of Philadelphia. By S. D. Risley, A. M., M. D. Extracted from the Transactions of the Medical Society State of Pennsylvania for 1881.

eration is concerned, it is more important than anything else that better methods of education—more thoroughly graded and systematized methods—should take the place of the immature, imperfect and unnatural processes now generally in use. In a strict sense, it is often not overwork, that is an over amount of work that is at fault, but rather badly arranged and regulated methods of work. The great remedy is to improve the school system all along the line.

Education is not arranged as it should be to develop the brain by a natural process from within outward, from center to periphery. Any system of education is wrong which attempts to overturn or change the natural order of development.

"In a wide sense," says Crichton-Browne,* "education and practical medicine have the same aim. The true conception of health is that it consists in the harmonious performance of all the functions of the being. From the lowest plant to the highest animal we unhesitatingly assume the health of a being as the most perfect manifestation of its life, and to secure this most perfect manifestation of vitality is alike the object of the school-master and the physician. They both strive to influence the organism so that it may be brought into conformity with the conditions of its existence: the school master, while inherent potentialities are becoming actualities, and while vital susceptibilities are most active; the physician, whenever harmony of function has been disturbed. The methods of the school master are mainly psychical; those of the physician are mainly physical; but he would be a poor physician who ignored the fact of consciousness, and he would be a useless schoolmaster who gave no attention to the working of material forces. The schoolmaster may be the physician's best ally, by training the intelligence to the best conditions of health, and inculcating those principles of personal and social ethics from the neglect of which disease and death so often arise. And the physician may aid the schoolmaster in his task by teaching the laws under which the union of conscious intelligence and the bodily frame is maintained and a condition under which the capacities and faculties of the mind may be most successfully evoked and strengthened."

The system introduced by Mr. MacAlister into Philadelphia has not been working long enough even in the lower schools—primary and secondary—to allow of any reliable investigations and comparisons as to the physical condition of the children as compared with the same under the old system.

Mr. D. W. Hutchin, one of the grammar school principals, in answer to an inquiry, writes to me as follows: "As far as I can learn from the teachers, there seems to be no observable difference in the health of our public school children of the lower grades, under the new order of things, from what it was before the old had passed away. To my

* Education and the Nervous System, by J. Crichton-Browne, M. D., LL. D., F. R. S. Reprinted from the Book of Health.

inquiries upon the point, nearly all the teachers answer, 'I have not noticed any change.' As a matter of fact, few of the teachers seem to be looking for the good results of our new methods.

"The published reports of the board of education show a slight decrease in the amount of sickness, and a corresponding increase in the attendance. In 1882, the number absent on account of sickness was 9.58 per cent. of the number belonging during the year, while in 1883 it was 9.19 per cent., and in 1884 but 8.50 per cent.

"The average attendance during the same years, excluding the sick, when compared with the average number belonging, was as follows: 1882, 79.86 per cent.; 1883, 81.03 per cent.; 1884, 82.27 per cent. Believing that these figures do show a tendency towards a better state of things, I take the liberty of sending them to you."

One grammar school principal writes to me with reference to this matter as follows: "The grammar schools are not feeling the full effects of the new system, but I believe that in the hands of faithful teachers the new system is far superior to the old, as its aim is to cultivate the reasoning faculties; but its success will depend on the faithfulness of the teacher, as any attempt on his or her part towards cramming or verbatim recitations, or teaching of rules, will be a failure. Again, it is founded on the inductive method."

Partly as a result of these investigations, and partly as a result of efforts made by members of the board of education and others, much improvement has been accomplished; and I am told seventeen hundred schools have been changed with reference to this matter. Still faults remain, and in my own personal investigations I found some of these. In one of the schools in the lower part of the city I found the children in two of the lowest grades of the primary divisions were sitting in perpetual twilight. It was impossible for those on the inner form to use the eyes without injury. The teachers told me that on days at all dark it was necessary to light the gas. This is sufficient to indicate that there are still some drawbacks of this kind. I found some other schools in which this same condition existed, but not to so marked an extent.

In spite of the improvement made, the ventilation of the schools of Philadelphia is still very bad. Some of the newer schools, built within recent years, are furnished with improved methods of ventilation, but even in some of these the methods do not work well. In the majority of the schools there is no special system of ventilation—only the ordinary window method—and even in connection with the windows no special apparatus. In the boys' high school the ventilation is by means of windows, and I discovered a great difference between the temperature of the rooms and that of the halls. I found on one occasion over sixty boys crowded into one room of this school, a room that had not seating capacity for more than forty, and should have accommodated only thirty.

With the assistance of Dr. M. H. Bochroch and Dr. E. J. McOscar, temperatures were taken in a number of the schools. While they were not very high, they were almost uniformly a few degrees higher than they should have been. The mere question of the state of the thermometer is not all in the discussion of questions of this kind. In many schools we found the temperature ranging about 74 degrees; in others 75; in others 76; the temperature as a rule ranged from 70 up to 75 or 76, but more commonly up to 73 or 74.

One great defect in the public schools of this city is in connection with the opportunity for exercise which is provided for the children. In some of the largest schools, in the best sections, the children have absolutely no place to engage in healthful physical exercise. In one of these large schools in which the number of pupils is perhaps 1,000, there is only a small side yard which is used chiefly by the girls, the boys having no place for exercise. Of course, much of this cannot be helped; still parents, teachers, and all good citizens should look out for the future. In many cases where no other opportunity can be afforded for exercise, the cellars and basements might be fitted up for this purpose. There is no inducement for children to make use of the recesses unless they have the opportunity and place to exercise. This I believe is one of the causes, with other hygienic deficiencies, of much of the ill health which has been reported.

I cannot go into the subject of drainage and sewerage, but in two or three of the schools a shocking state of affairs was found. In the Sargent Street Girls' Grammar School, where, by the way, the teachers meet weekly to discuss health and educational matters in a certain room, the atmosphere was simply mephitic. Certain glaring defects existed in the sewerage arrangements and the position of this room to the water-closet.

A sound nervous system is undoubtedly a most important factor, so far as an individual's capability of education is concerned. A good education will do more than anything else to develop and strengthen the nervous system. The lay ideas of mind are peculiar and warped, and in this fact is to be found one of the faults in dealing with the question of education. It is forgotten by educators, and those who control and govern educators, politically or otherwise, that the equal and even development of every part of the human body is essential to the perfection of the nervous system. In one of the lectures to teachers at the board of education rooms, I heard repeated the old expression that the special senses are the gateways of the mind. This is true; but they are more than this; they are an essential part of the mental apparatus itself. Many years ago Gall and Spurzheim gave us a phrenology which was first received with skepticism, then believed in by multitudes, and finally hooted at by all but a few. Their peculiar views have properly enough gone by the board, but the germ of a great truth was in this old phrenological science, and by better

methods in abler hands this has been developed in recent years into the great doctrine of brain localization.

When the hand is used for any delicate work, when the arm is employed in striking or pulling, when the foot and leg do their part in dancing or walking, when the eye gazes upon a landscape or takes in the contents of the page, when the ear is tuned to music or to discordant sounds, when the sense of touch is exercised, certain special regions of the brain re-act in consequence of the peculiar peripheral impressions which are made. The resultant of these re-actions, combined with the processes of attention, memory, association, judgment, etc., consitute that great something which you choose to call mind. The leg, the arm, the eye, the skin, each has its mental response so far as its physical activity is concerned.

Without going into any metaphysical discussion as to what mind is, no doubt can exist that the nervous system, and particularly the brain, is its chief organ. In this sense the mind is the result of the harmonious working together of all parts of the brain, and all parts of the brain are connected, more or less directly, with all parts and organs of the body. Mind is not a little something located in a small portion of the encephalon—in some little gland, or minute bone cavity.

It may be laid down as a general proposition that overwork, physical or mental, is capable, directly or indirectly, of producing the most serious disorders of the nervous system and mind. Mental overwork differs from physical overwork in essence simply in the fact that different or larger cerebral areas are concerned in the production of the effects of effort. It is only on special occasions, if at all, when higher intellection, pure and simple, is going on, that the regions of motion and sensation are not concerned in the production of what appears as the mental output in a given case. Indeed, in this great fact that physical activities, normal or abnormal, specific and definite, so far as certain acts are concerned, accompany higher mental activity, and that the brain is detrimentally acted upon in a two-fold manner, resides the explanation of some of the worst evils of so-called mental overwork. It is mental overwork and the physical and emotional strain which go with it, that lead to the dire result.

The influence of overwork in the production of nervous diseases and insanity is, on the one hand, sometimes overrated, and, on the other, frequently overlooked. It has always been a favorite subject with tyros in medicine and social science, but it is one which requires large practical experience and wide knowledge of disease in order that it may be copied with properly.

A good way to lead up to an understanding of the disastrous effects of mental overwork upon the mind and nervous system is by first considering those tangible and easily recognized nervous affections which are the result of special forms of physical overwork. Such a consideration will show that between the effects of physical and mental over-

work the difference is apparent rather than real. It is a common experience to observe certain physical effects, such as general exhaustion, tremor, temporary paresis, and, more rarely, forms of spasm, result from physical over-effort. George Vivian Poore,* and others, have well designated certain affections as "fatigue diseases." These disorders are those which have been described under various names, such as the cramp, spasm, or palsy of writers, pianists, telegraphers, type-writers, blacksmiths, tailors, milkers, weavers, etc., and are also sometimes considered under the general designation of "artisans' diseases." What is the clinical history of such cases? How do they arise, and how progress? In general terms, they are the result of interference with that "rhythmic nutrition" which Sir James Paget has declared to be one of the great laws of nature, a law the violation of which entails pain, disease and, it may be, death. It is not work, physical or mental, which leads to these dire results, but overwork, in the strictest sense of the term. Work, within normal limits, leads to normal fatigue, which, in its turn, calls for rest, in order that recuperation may occur; overwork leads to abnormal fatigue, and, at its worst, destroys even the inclination to that repose which helps to carry out this great law of rhythmic nutrition.

In these fatigue disorders it is the monotonous, everlasting repetition of the same forms and processes of work which brings about the ill results. Not only are the muscles and nerves concerned in such apparently simple, but really complicated physiological acts as writing, telegraphing and the like, exhausted beyond recuperation, but the nerve centers, spinal and cerebal, which control and harmonize these acts, are themselves eventually exhausted, and, if the cause continues, they may be destroyed. The evident conditions in these cases, what the doctor calls the "symptoms," are the pain, the cramp or spasm, the tremor, the paresis, the incoördinate movements, the flag in attention, and the undue emotionality, which are seen to be present, or of which the patients complain. The hidden condition in these cases, what the doctor calls the "pathology," is the change, impalpable and not yet demonstrable it may be, of the peripheral and central neuromuscular apparatus which has been brought about by its over use. The weight of recent opinion is undoubtedly in favor of the view that the seat of the greatest pathological change in these cases is in the central nervous system; doubtless in some of them it is in the gray matter of the brain cortex.

Over-physical fatigue of muscle, of eye, ear, tactile papilla, etc., then, means exhaustion of nerve centers, spinal and cerebral as well. One of the clearest truths of modern cerebral physiology, one of the most widely known results of investigation into cerebral localization, bears out this truth. Every isolated muscular action, every action the re-

* Electricity in Medicine and Surgery.

sult of the movement of a group of muscles. has its record in the cerebral cortex: each muscle or muscular group has there its center or governing spot. The brain acts in levels. in areas, in zones, in centers, or there is no truth in the now multitudinous observations and experiments which go to prove the doctrine of localization. Motor and sensory localization at least may be regarded as established. Differences of opinion may exist, and will probably continue to exist, as to the exact nature of this localization—whether in the brain we have a mere loosely linked confederation, or whether these localizations are simply centralizations of certain vibrations, etc.—but no doubt can remain as to the truth of some method of localization. Certain areas of the brain are destroyed, and certain muscles are palsied and eventually degenerate; a limb is amputated, or its power or size destroyed by a spinal or peripheral disease, and years after certain brain centers are found wasted or obliterated. A man like Gambetta, distinguished for mental grasp and particularly for eloquence and fluent speech, is found with a certain convolution doubly developed. Excessive muscular action is shown by Lombard. Amidon and others to result in increase of local temperature in certain regions of the cranial vault. From both aspects of the question is demonstrated the possibility of central nervous effects from peripheral causes.

In a case which recently came under my observation, through the kindness of a brother practitioner, the fact that even higher volitional centers may be demonstrably exhausted by over exertion was beautifully illustrated. The man was a singer and actor in a popular troupe. In order better to counterfeit the character which it was his duty to represent on the boards, he was in the habit nightly, for many minutes at a time, of frightfully contorting his face and eyes, accomplishing a strikingly effective artistic feat. Both eyes were made to strongly converge, the forehead at the same time was corrugated, and the muscles of the cheek were drawn into special positions. One day he suddenly saw double. His double vision persisted and became more annoying, and it was soon discovered that he had paresis of the external muscle of one eye, some pain accompanying the trouble. That the condition was really due to exhaustion of cerebral centers appeared to be demonstrated by the fact that he could, by great effort, for a moment or two cause the affected eye to rotate outwards beyond the medium line, although ordinarily it this could not be done.

At first sight these considerations and illustrations may seem to have little to do with the question of mental overwork and its consequences; but such is not the case. It is in consideration of facts of this kind that the true philosophy of neurasthenia or the philosophy of a true neurasthenia becomes evident. If motor activities are governed by definite cerebral centers, which can be exhausted, and whose nutrition can permanently be arrested or impaired, mental activity, abnormally exerted, can certainly lead to impairment of cerebral

centers. Physical overwork means cerebration, as well as mental overwork—both have their brain reaction.

Not a few of the organic spinal affections which pass under the name of sclerosis are produced or determined by over-physical exertion. Even when syphilis, alcohol or sexual abuses have played a part, sometimes physical overwork has been the last factor in the production of the diseases. During or succeeding some great military campaigns many spinal disorders have resulted, because of the extraordinary fatigue of long marches and unusual exertion. A number of cases of locomotor ataxiâ, not due to syphilis, alcohol or exposure, occurred among soldiers on both sides during our late civil war. It is well known to electro-physiologists and electro-therapeutists that a muscle can be faradized or galvanized, until both it and its nervous centers are so thoroughly exhausted that almost total paralysis occurs. That cerebral centers for the special senses can be exhausted by overuse of the organs of special sense, has been shown by numerous clinical facts.

Let me say a few special words to those adults who are overworking themselves almost daily, often both unconsciously and unnecessarily. In the first place, while it may seem almost absurd to repeat the trite dictum that they should do less work, this is really the first truth to be learned.

Individuals are often forced into such positions that they cannot, at given times, do less than the amount of work that is called for in a certain number of hours, but it is the prophylaxis of overwork that should receive their careful thought. They should not push the ox into the ditch, in order to compel themselves to pull it out on Sunday; they should provide from day to day, from week to week, and even from season to season, against the possibility of being thrown into positions where temporary overwork becomes absolutely necessary. Their work should be more carefully anticipated. I know well that different vocations in life will make great differences as to the possibility of more or less absolute systematization, but something can be done in this respect, even by those who belong to the most taxing and irregular of professions.

An important practical point—one too often overlooked by overworked men—is the great value of brief intervals of repose during working hours. These can often be had, even by those who think it least possible. The recumbent position, with the general physical and sometimes mental relaxation which it brings, even without sleep, often serves to knit together again the tired faculties. Where the habit of snatching these intervals of sleep can be acquired it is of very great benefit. It would be far better for those who are overworked to resort to these methods of recuperation rather than to stimulants. Stimulants are always a dangerous ally when resorted to during the progress of crowding tasks.

Those who are forced to no much work in a short time should learn to avail themselves of all possible auxiliaries to lighten labor and save time. The day has gone by when the busy statesman, or novelist, or lawyer, or physician, can afford to spend tedious hours in doing the mechanical work of writing speeches, novels, opinions, or professional experience. Stenographers and type-writers have become invaluable and indispensable auxiliaries to men of many labors. A word of caution is here necessary, however; there is a possible danger that with these auxiliaries which make the achievements within reach much greater, the ambitious, hard-worked individual will set to himself far greater tasks than he would under other circumstances.

Some system of medical superintendence in our public schools should be adopted. Much good could undoubtedly be accomplished in this way. In some foreign cities, and possibly in some municipalities in this country, systematic medical inspection and superintendency of schools has been adopted. Crichton-Browne has recommended such superintendence of the London schools in consequence of the personal investigation which he made into a number of the elementary schools of London. It is not necessary that there should be a cumbrous and costly system of medical inspection and superintendency. In connection with the general superintendency of our schools, one or more medical men might be employed to systematically inspect and report upon the sanitary condition of school buildings and surroundings, and upon the health of the pupils. It may be a question as to how such positions should be filled, or in connection with what department of city government they should be held. Some might consider it best to have such medical superindence in connection with the municipal board of health, but as our city departments are at present constituted it would probably be better for the medical superintendents or inspectors to hold the position of assistant superintendents, or, at least, a position of similar rank under the school department.

With a thorough system of medical superintendence of the public schools in active operation, the most serious evils in school life and in work might be avoided or remedied. Such questions as ventilation, lighting, seating, drainage, vaccination, the presence of children in whose families contagious diseases prevails, would come under the jurisdiction of such medical inspector or superintendent. Special investigations could also be made or directed, from time to time, with reference to the number of studies, hours of home work, amount of recreation and sleep, and the effect of all these upon the health of children in certain schools or districts. Reports upon these matters could thus be systematically made to the superintendent of the public schools.

Not only could much be done for the avoidance of disease and im-

provement of the health of school children by a well-directed medical superintendency, but much information of the greatest scientific value could be obtained, and put into shape for general usefulness, by a system of health registers in schools. Such a register, says Crichton-Browne, who strongly recommends it, could be so arranged as to supply a clear and complete history of the vital and educational progress of each pupil as long as he or she remains in school. "But more valuable and trustworthy than even a medical report," says this writer, "would be a register of height, weight, head and chest girth of the children were such a record kept in every school. A log-book of this kind would help us much in doing justice to the teachers and children alike and in putting a stop to over-pressure. At present the only basis of classification of school children recognized is the age difference, no allowance being made for health or development or radical differences. But no one can walk through a few schools in different districts of London, and with different rates of payment, without being impressed with the wide interval of health and development that separates children in the best from those in the worst. The latter are puny, dwarfish, pale and feeble when compared with the former; and to judge a teacher who is laboring amongst them by the same standard that is applied to another whose lot is cast amongst larger-limbed and larger-headed children, with richer blood and more constitutional vigor, is to do him a manifest injustice and incite to over-pressure. But injustice of this kind would vanish at the appearance of the tape measure, for the average height and weight and head and chest circumference of the children would supply just the check which is required on the results of examination."

If school children are overworked, it may be to some extent the fault of their parents. The parents should look more to the school interests of their children. I recently asked the principal of a grammar school whether the parents visited the school. He replied, "Oh, they visit the school; at least some of them do." "When do they visit the school?" I inquired. "They usually visit the school just after examination week, to see why John or Mary has not been promoted. They make the teacher's life miserable for some time after examinations; but they seldom visit him at any other season."

For certain special health matters, parents are largely responsible. I am credibly informed that a large number of the pupils of the girl's normal school are found in their places each morning without having had any breakfast. It stands to reason that a child will suffer from nervousness, headache, eye strain, etc.—ills which come from a run-down state of the system—if such a state of affairs is allowed. A diet of doughnuts is not the best for either mental or physical development; but I can affirm without fear of contradiction that in the girl's normal school of Philadelphia doughnuts are the most popular luncheon in the intervals between the different sessions. When I was a

boy a diet of cheese cakes was the favorite; but as I had plenty of active exercise in my journey of four miles to and from my home, I did not suffer as much as I otherwise should have done. Parents should know what their children eat at school as well as at home. Arrangements should be made in the schools in which long hours prevail by which the children can break their fasts with healthful food during the day.

Parents should see to it that their girls are not driven too hard during the menstrual periods. They should take care that both boys and girls should not study too hard at certain diurnal periods—for instance, immediately before bedtime. It is well known that hard study immediately before retiring to rest will do much towards injuring the health and preventing sleep. Great mental application, continued until too near the time of retiring, or beyond the usual hour, keeps the blood within the head at the time when it should leave it.

The parents of the pupils constitute the great people, politically, of Philadelphia, and these parents should arise in their might and uphold those who are using their strongest and noblest efforts to promote the interests of our school system. They should arise and protest against bad school buildings and insufficient appropriations for educational purposes; they should see to it that those faults which could be remedied with money are removed.

Many teachers are overworked. I believe also that they are underpaid. The real overwork in the case of many of the teachers and the real injury to health seems to me to be due rather to the methods of working than to the actual amount of ground that is covered. Ill health of teachers is also due to sanitary defects. Teachers are compelled to live from nine o'clock in the morning till four o'clock in the afternoon, nearly all the time in ill-ventilated rooms. They are compelled in some cases to pursue certain methods of teaching which are unnatural, or for which they are untrained. They are bound to suffer sooner or later. Of the graded schools the complaint has been made to me that the work is harder for the teachers than under the old system. I have taken care to observe the methods of teaching in a number of schools in different sections working under the new system. Different schools differ very much. I believe that the supposed overwork from the new method of teaching is due in many cases to the fact that the teachers have not yet accustomed themselves to the new method.

XI. The Necessity of Physical Education.

By Carl H. Horsch, M. D., *of Dover, N. H., member State Board of Health of New Hampshire.*

The ancient Egyptians and Persians had their physical training and athletic sports, which are described by Diodorus, Herodotus, Strabo and other writers, but the first systematic physical education as a necessity of popular culture was practiced by the Greeks; they had gymnasiums and better regulated athletic social sports, yet Euripides spoke

1. Abduction.

of Grecian professional athletes as being useless and injurious members of society.

Later, we find a still better development of physical training among the Dorians and the Spartans. Xenophon called the Spartans the healthiest of all the Greeks.

Martin Luther and other reformers advocated gymnastic and phyical education, and later advocates were Rousseau in France, Jahn the father of German Turners, Clais in Switzerland, Nachtigall in Den-

mark, Ling in Sweden, Maclaren in England, Beck, Folen, Dio Lewis and others in America.

In 1849 a law was passed in Switzerland to make calisthenics and gymnastics obligatory in educational institutions. All who have this important sanitary measure at heart hope and wish that this country may follow that example; because mental and physical culture are the most necessary conditions for the maintenance and propagation of republican principles, and for a vigorous, prosperous, free nation.

Rightly applied, physical exercise is a very important aid to circulation and mixing of our blood, digestion and assimilation of the food, growth, production and reproduction of the system.

2. ADDUCTION.

Breathing is accelerated by rational bodily exercise, and a more appropriate exchange of oxygen, carbonic acid and water secured.

The heart beats more forcibly and frequently, and the blood and its nourishing constituents are better distributed. Digestion and the appetite are improved on account of increased absorption, waste and greater demand for food. The tone of the nervous system is also improved.

Gaskel and Moose have demonstrated and proved by experiments, that the flow of blood is increased during the period of contraction of the muscular fibres.

Dr. Edward Smith* has made experiments regarding the effect of exercise on the respiration; he gives the relative quantities of air inspired during various forms of muscular exertion, the amount inspired in the recumbent position at rest being taken as unity in one table, in a second table the pulmonary elimination of carbonic acid during exercise, as compared with rest.

Pettenkofer and Voit made experiments "upon the elimination of carbonic acid and absorption of oxygen during rest and exercise;" by the aid of an apparatus they give with a higher degree of accuracy than was attainable by Smith's method, the average elimination of carbonic acid and absorption of oxygen in grains. Other scientific observations have been made by Liebig, Wislicenus, Helmholtz, Flint and others.

Beneficial kinds of exercises are:

* Physical exercise by A. Brayton Ball, M. D., supplement volume on hygiene and public health. Ziemssen's Cyclopedia.

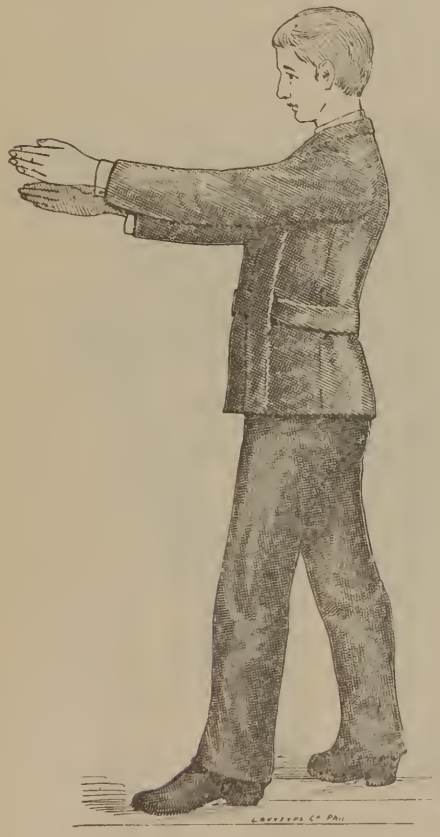
1. Exercise out of doors, which secures the advantage of better air, change of atmospheric pressure, and more light.

2. Exercise out of town, where the air is purer than in thickly settled places.

3. Calisthenic free exercises, by which we use all the voluntary muscles.

4. Vocal gymnastics, whereby the respiratory organs, organs of speech and voice are improved.

5. Hellenic, Swedish gymnastics, turning, and training for rowing, aim at forced muscular contractions, for which there are various ap-



3. Attraction.

4. Retraction.

paratus, and whereby the nutrition of the muscles is promoted. It is also necessary to balance our body right. Tissot in France, and Ling in Sweden, established gymnastic exercises for the treatment of certain diseases.

The voluntary muscles classified by their actions are:

1. Abductor muscles, whereby the extremities are drawn from the middle line of the body.

2. Adductor muscles, which carry the limbs to the middle line of the body.

3. Attraction muscles, whereby we move the parts forward.

4. Retraction muscles, move the parts backward.

5. Extensor muscles, stretch the body and extremities.

6. Flexor muscles, bend the body and limbs.

7. Rotator muscles, turn the parts on their axis.

8. Pronator muscles, turn the parts forward and inward.

9. Supinator muscles turn backward and outward.

5. EXTENSION.

6. FLEXION.

10. Depressor muscles, draw the lips, side of the nose and angle of the mouth down.

11. Levator muscles, lift and raise the parts, as eyelids and lips. The two latter and the sphineter and constrictor muscles are not as much under our command as the other nine kinds of muscles.

Permit me to call the actions of the voluntary muscles the alphabet to a more rational systematic and beneficial exercise of our body.

Without the knowledge of these actions calisthenics and gymnastics remain to a greater extent automatical. The necessity of physical education will certainly be better comprehended and valued when we teach fundamental principles. Erasmus Wilson said: "In mind lies the great secret of beneficial exercise, and without it exercise is a misnomer, and a fraud on the constitution."

There are already a number of educational institutions where physical exercises are practiced, and also gymnastic institutions and athletic clubs, the German Turner Vereins and the American Turner Bund; but if intelligently directed rythmically executed physical

7. Rotation.

exercise is required in every college, and properly arranged places and apparatus for calisthenics and gymnastics are in every school house, then the teachers and scholars can improve their physical conditions and have systematic means for a more useful and symmetrical development of their bodies.

Anthropometric apparatus, by which we can determine breathing power, strength of pull, squeeze, quickness of blow, and other personal

data, would be well for annual examinations, and give an impulse for better attention to physical education. When I visited the "International Health Exhibition" in London, in 1884, there were hundreds of persons waiting for a chance at the entrance of the "Anthropometric Laboratory," to be admitted and examined.

The laboratory was arranged by Francis Galton, F. R. S.; he had the following apparatus:

1. For eyesight: (*a*) its keenness; (*b*) the color sense; (*c*) judgment of the eye in estimating length and squareness.

2. Hearing: (*a*) its keenness; (*b*) highest audible note.

3. Touch (exhibition of various instruments).

4. Breathing capacity; his spirometer was used.

5. Strength: (*a*) of pull; (*b*) of squeeze with right and with left hand.

6. Swiftness of blow with fist.

7. Span of the arms.

8. Heights: (*a*) when sitting; (*b*) standing.

If we consider that attention to the various sanitary measures is an imperative duty for all cultured people, and that a better physical

development is needed, we hope that they will adopt the recommendations of the Boards of Health, American Public Health Association, and of the present Sanitary Convention.

All intelligent just persons will acknowledge that the efforts made by such sanitary institutions are unselfish and for the welfare of humanity.

EXTENSION.

I think to stretch the body, the right arm and leg, then the left arm and leg is better.

If we commence with the here illustrated motions, we are sure that we have brought the voluntary muscles, which can be entirely controlled by our will, into rational, systematic, physiological actions, and have them better prepared for daily labor, forced muscular exercises, as gymnastics, boat rowing, etc., for a better balance of our body, and a development of agility and vigor.

The following illustrated exercises should be made at least three times a day and every motion three times, which can be executed in about two minues. There are many vocations were persons use and even overtax some of their voluntary muscles, but do not contract the

fibres of the other sets of muscles, whereas circulation of the blood and all functions need that physiological action.

1. Use the abductor muscles by spreading the extremities and move them from the middle line of the body.

2. The adductor muscles are well used by drawing the limbs as close as possible to the middle line of the body; you can do it after each abduction, but it is better to draw the limbs close to the body by separate motions, and when the extremities are about one inch from the body.

3. Attraction muscles are used by making a step forward, and every step throwing the arms forward.

4. Retraction muscles by stepping backward, and with each step throwing the arms backward.

5. Use the extensor muscles by stretching the body, the right arm and leg, then the left arm and leg.

6. The flexor muscles, by bending body, neck, right arm and leg, then left arm and leg.

7. Rotation muscles by turning the head as much as possible to the right and then to the left, and turn the arms and then the legs on their axis.

8. The actions of the pronator and supinator muscles are illustrated on one figure; you find the right hand pronated and the left supinated; first exercise hand and wrist, then feet and ankles.

XII. Heating and Ventilation of Public School Buildings, as Illustrated by the System introduced into the New High School Building at Chester.

By D. W. JEFFERIS, M. D., *of Chester, Pa.*

There have been in recent years great advances in the construction and arrangement of public school buildings. We now recognize the fact that the eyes of our children may be permanently injured by insufficient light or light from wrong directions. The furniture is now graded to the size of the pupils "whose feet no longer hang down, anxious in vain to reach the distant floor."

It is pretty well understood that the location should be healthful, and the grounds ample for exercise. But I doubt if in the great majority of cases our heating and ventilation is in any way better than it was in the days of the ten-plate stove and wood fires of our forefathers.

It is true that many efforts have been made at improvement, so that we find in the different school rooms stoves, hot air furnaces, and steam-heating apparatus, with direct and indirect radiation. Stoves are objectionable because the room is heated unevenly. The pupils

near them suffer from excessive heat, while those in distant parts of the room suffer from cold.

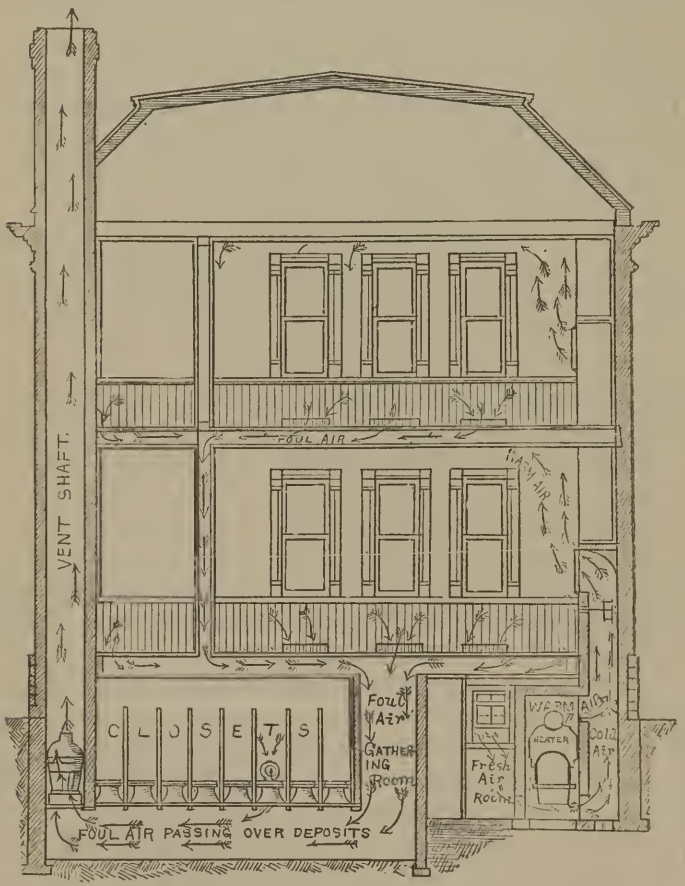
Hot-air furnaces are objectionable because the air is dry and superheated, and the burnt organic materials contained in it act as irritants. Indirect steam heating is perhaps the best of the three, and if the radiators are large enough and the warmed air can reach the rooms in sufficient quantities, leave perhaps but little to be desired, provided proper arrangements could be made to get rid of the air when it becomes contaminated. Still it has never been my good fortune to see a school room where these conditions were complied with, direct heat from radiators in the room being also required to keep it to the proper temperature. A good system of steam heating is necessarily expensive in construction, fuel and repairs, so that boards of education generally are compelled to accept plans which either fail in heat or ventilation, and most often in both.

So the air in our school rooms is impure and unfit for respiration. The teachers and pupils are alike dull, and all complain of cold feet and headaches. The school life, which normally should be bright, pleasant and healthy, is a time of weariness and languor. In it too often are sown the seeds of decay and death.

The careful teacher, instructed as required by our legislators in anatomy, physiology and hygiene, recognizes the necessity for pure air, and ventilates by raising the windows or lowering them from the top, the popular fancy being that bad air ascends. Thus she creates injurious drafts, and by choosing a lesser evil sacrifices the few children who sit near for the benefit of the many in distant and more sheltered parts of the room. So it was a serious question with the building committee of our board whether it would not be as well to make no provision for ventilation, lest our teachers should put undue reliance upon it, and neglect the old and obvious way. If any one, unconversant with the subject, doubts the assertion that, as a rule, school rooms are not well ventilated, let him spend one day in school visitation; he will then find abundant evidence. It will not be necessary to use instruments of precision, or make chemical analyses to calculate to a nicety the amount of deleterious substances in each cubic foot of air; on the contrary, his sense of smell will at once warn him of danger if he remains long in the contaminated atmosphere. Our new high school building will contain in round numbers 100,000 cubic feet of air in the different rooms. It will accommodate 400 pupils. As each person will contaminate ten cubic feet of air every minute, which is a sufficiently low estimate for health and high intellectual activity, it will be seen that in twenty-five minutes all the air in the building will be impure, and should be replaced by fresh air; this, in our climate in the winter season, should be warmed air. No arrangement with which I am acquainted, either by stoves, hot-air

furnaces, or steam-heating apparatus, will warm sufficient air to effect this. If we cannot take into our high-school building more than 20,000 feet of air every hour, there is insufficient ventilation; for foul air will remain in the rooms until it is replaced by fresh air.

While investigating the subject our attention was called to the system which we have after full inquiry and examination of buildings in which it was in use, adopted, satisfied that it will fill all our requirements and accomplish all that is guaranteed by the builders—that is, change



SMEAD'S SYSTEM of DRY CLOSETS Patd. 1885.

the air in all the rooms at least three times an hour and keep them at a temperature of 70° in the coldest weather, at a less cost than by stoves, hot-air furnaces or steam-heating apparatus. To warm this large body of air they will place in our basement four large heaters, or more properly air warmers (see cut). These are built of heavy iron so as to be durable, are patterned after the locomotive boiler—tubular—and hence furnish a large radiating surface—260 feet in each furnace—and retain the heat of the burning fuel as long as possible. To them the outside air is freely admitted; being warmed to a tem-

perature of about 125°, it rises through brick flues to the school rooms above, entering the rooms through ample registers; by a simple arrangement, the teacher can by moving a hand upon a dial regulate its admission, either mixing it with cold air, or shutting off the supply of warm air altogether, admit only cold air; but she cannot lessen the quantity of air coming into the room. Having entered the room it rises to the ceiling, forcing the contained air gradually downward, and out through the ventilators placed under each window. These vents are put under the windows for the reason that there is more or less downward movement of air in this position, as windows are never completely air-tight, and the air in contact with them is cooled from the outside. Going out of the body of the room the now contaminated air still at a temperature of from 60° to 65°, passes directly under the floor; it being laid upon furring strips to afford space for that purpose. This keeps the floor always dry and warm, which is in itself a very great advantage over other methods. In the basement there are foul air gathering rooms, from which the air passes to the ventilating flue built in the smoke stack. I trust I have made the system plain, and you will pardon me if I call your attention to another very important feature which we have adopted in connection with this system. Somebody has said that he could judge of the civilization of a people by the condition of their privies. If our school children are to be judged in this way their state is low indeed. These closets are the bane of all school officers, filthy and offensive alike to sight and smell. It has seemed impossible to better their condition. Between the foul air gathering rooms and the ventilating shafts we have placed our closets. Through each set of closets there will rush 150,000 cubic feet of dry, warm air every hour. This air having already accomplished the two-fold purposes of warming and ventilation in the rooms above, now is called to another office, and as it sweeps up the big chimney carries with it all the moisture and bad odor in the excreta, leaving behind it only a small quantity of inodorous material which burns readily, and may be actually burned in situ, or thrown into the furnace. No mal-odors can possibly reach the school rooms. During the summer months the free circulation of the air is secured by small furnaces built in the base of the stacks. Thus is obviated all necessity of raising the windows at any season. In winter there can be no drafts, and in summer comparative freedom from dust and noise.

Just as I had concluded this paper I received a letter dated May 5, 1886, from H. S. Jones, superintendent of public schools of Erie, Pa., from which I take this extract:

"We have our building No. 3, a six-teacher house, warmed and ventilated by the Ruttan system. The plan in brief is to have large quantities of warmed air (not hot) pass into the room and pass out under the floor, thence to the ventilating shaft or foul-air stack. The theory as outlined is a fact in No. 3 building. The air at no time dur-

ing the coldest days gave any indication of impurity, though no windows or so-called ventilators were used to let in fresh air. All air comes in through the heating chamber and passes out under the floors. Most of our other buildings are what are called well ventilated, but it was noticeable when a wave of influenza passed through the town that the pupils in No. 3 suffered much less than the others from illness, or that state of the mucous membrane of the nose that shows more or less congestion which leads to catarrh, etc. The floor at all times being warm made it especially pleasant to the younger pupils, as no windows are opened, no drafts are chilling pupils' heads and shoulders, causing earache, toothache and colds. Large amounts of warm air cost somewhat more in fuel than hot air, but nothing pays better in health, comfort and cheerfulness."

Allow me in conclusion to say that I have no interest whatever in any mode of heating, save that general interest which every medical man who is a school officer must take in the well-being of the children entrusted to his charge; and if it were necessary to choose among evils, I would prefer poor books, bad furniture and low-grade teachers, before poor ventilation. I trust, however, that in our new building we will avoid all these evils, and if you will come to Chester, will be glad to show you on any cold day next winter our success or failure.

XIII. Defective Vision in School Children.

By PETER D. KEYSER, M. D., *of Philadelphia*,

Professor of Ophthalmology in the Medico-Chirurgical College of Philadelphia

Mr. PRESIDENT: Absence from the city until two days ago prevented me from learning that I was selected to read a paper on the subject of "Defective Vision in School Children" before this convention. The time has been so short and my engagements so pressing that it was utterly impossible for me to prepare a full and proper paper on this very important subject for this occasion. I have, however, thrown a few ideas and suggestions together for the purpose of opening the discussion, to draw out the feelings and expressions of those present on the subject.

Up to 1863 the complaints of children in relation to defective vision were made but light of. When complaining of headache, pain in the eyes, sleepiness on study and inability to see the blackboard or study their lessons, it was taken as an excuse for laziness, inattention, or some form of disordered stomach or liver. The anomalies and defects of refraction of the eye were not known or really in their early beginning of discovery and development. Until the discovery of the ophthalmoscope in 1351 by Helmholtz, the fundus of the eye was as

unknown and impenetrable as some of the thick jungles of Africa. Everything in relation to the inward eye was but supposition; but after the discovery and development of this famous little instrument, a new world was opened to us, and one of the most brilliant and beautiful pictures of nature was revealed. In a short time the study of the parts contained in the eyeball, such as the normal anatomy and then the morbid changes found in diseases of that organ were made, and then the normal and abnormal refraction were discovered. This led to the more perfect study of the defects in vision when the fundus appeared normal and there was no disease apparent about the external eye. Professor V. Graefe, of Berlin, did so much in the detection and classification of the diseases of the inner eye; while Professor Donders, of Utrecht, Holland, worked out and classified the anomalies of refraction, and published his great work on the subject in 1863. Since then the examination of all classes of people as well as school children, has been undertaken by ophthalmologists of all lands and countries; and from their experience, it has been found that these complaints of children when in school or studying have been and are well founded.

These defects are brought more prominently to our view for the reason that the number of children increases as the population augments, and the schools become more frequented, by the compulsory laws on education in the land.

The defects of refraction being more or less congenital, show naturally in the early years of school life, when the eyes are used to accommodate for some length of time at close work in study.

The defect of vision in the eye causing the troubles are divided into two classes, viz: Hypermetropia, or too short an axis, from the ball being too flat anteriorly-posteriorly; and myopia, or too long an axis, from the ball being too long anteriorly-posteriorly. Astigmatism is part of one or both of the above in a special axis; and it may be combined with either in the same eye.

The causes, then, of defective vision in children are, laying aside any congenital defects in the media or tunics of the eye or inflammation of the same, a more or less irregularity in the shape or rotundity of the ball.

Hypermetropia causes great strain upon the accommodation in the act of concentrating the vision in study, and may create varied troubles; pain in the head, in the eye itself, inflammation of the conjunctiva, and of the edges of the lids, and various curious reflex irritations. Careful and proper correction of the defect in refraction by glasses removes the cause of these troubles, and they can often be readily and entirely banished.

Myopia, near-sightedness, is of a more serious character. Here we are more liable to have severe and insidious inflammatory action in the tunics of the eye—the retina, choroid and sclerotic. This form of

defect is more apt to be acquired than congenital; and if congenital, is increased by improper use and strain of the eyes. All myopic eyes are more or less diseased, that is, weak and liable to inflammatory action; and this inflammation to be at the fundus of the eye-ball, in the choroid and its neighboring tunics. By this inflammatory action the tissues become softened and from the intra-ocular tension gradually give way backward, and thus elongate the visual line so that the focus does not reach to the retina, and the near-sightedness becomes increased.

The causes of this inflammatory action and increase of myopia are many and various; reading in a bad light, whether in dimly-lighted rooms or at twilight when the clear light of the sun has passed away; reading lying down is injurious. Desks too low, so that the child acquires the habit of stooping over or lolling on the desk, are bad. All these cause the eyes to be brought too near the object, requiring too great convergence of the eyes in use, creating strain, congestion and inflammation. The head being thrown too much forward gives the tendency of an increased flow of blood to the eyes and thus over-filling of the vessels.

To remove all these causes is of the greatest necessity, and the school houses should be better lighted. The windows should be larger to admit more light as well as air, and not sacrificed for the whim and style of architectural beauty of the architect. In other words, the light necessary to be admitted into the rooms should be the first object in building school houses, and not the architectural beauty. The windows should have shades rising from the window sill, or inside shutters so arranged as to exclude the bright light from the seats near the windows, and not interfere with its passing over into the deeper parts of the room. By this arrangement a better equalization of the light in the room can be obtained.

As the classes are arranged by mental capacity and learning, and not the bodily size of the children, the desks should be made to raise and lower, so that the scholars can be made to sit erectly in front of them. The seats may also be thus made so as to make a comfortable and convenient position for the lower limbs while sitting at the desks.

Another cause of irritation to the eyes is the use of glossy paper in the books. The glare created thereby is very unpleasant, and at times blinding. All books should be of clear, well defined type, black ink, on a plain dull surfaced paper. This has been found the best and most serviceable. Tinted papers do not answer so well. They are more expensive, and where there is a natural weakness of sight (amblyopia) the definition of the letters and figures is not sharp enough for such vision.

A general as well as serious habit in children is that of holding the book very close to the eyes, with the idea that they can comprehend the letters, words and meaning better. This should be guarded against.

I have noticed this to be very general in small children, and it should be carefully watched and corrected, as the strain upon the organs of vision in this way often engenders the first seeds of many of the inflammatory troubles in the fundus of the eye, and causes serious near-sightedness.

Irregularity of vision or astigmatism is found mostly in the shape of the cornea, so that the rays of light passing through that part into the eye are not equally refracted. This is mostly of a congenital form, and should be corrected by the appropriate cylindrical glasses.

Defective vision is also caused by opacities in the cornea, remaining from some form of inflammation or ulceration. In many cases this may be relieved or removed by the proper medical or surgical treatment while the subject is still young.

The proper seating of pupils in relation to the light should be arranged. Up to within a few years the teacher was seated between the windows, with the blackboard behind her, and the desks so placed that the pupils faced the light of the open windows. This is a very injurious position; the light falling directly in front of their eyes, and at the same time shading the blackboard, requires strain to decipher the figures or writing thereon. The light should come in from the side over the shoulder. The left one is the better, as it falls clearly upon the books and slate without any shade from either hand or pencil.

Defect of color perception hardly comes into the discussion at this time, but it is well that children should be educated in the detection of all shades of color while young. There are cases of congenital defects which cannot be remedied, while there are others of a dullness in perception which can be brightened up by careful and proper education.

All these suggestions are of such great necessity to protect the vision of our children, that I think the State Board of Health should have the supervision of the building and furnishing of all school houses, as well as the inspection of the same and the pupils during the seasons of study.

XIX. An Epidemic of Diphtheria Traced to Its Source.

By Benjamin Lee, A. M., M. D., Ph. D., *of Philadelphia*,
Secretary of the State Board of Health of Pennsylvania.

Every opportunity for tracing an outbreak of preventable disease to its presumably preventable cause is precious to the sanitarian. It speaks more loudly than mere words ever can to the public ear, which he desires to impress.

Such an opportunity, most striking in its character, has occurred in this State during the past year with reference to that wide spread and fatal zymotic, typhoid fever. I wish in this brief paper to parallel it with another which I had occasion to study some years since, and which is not less instructive because less recent, in regard to that equally prevalent and even more destructive contagion, diphtheria. Let me at the outset call attention to the difference in the mode of introduction of the poisons or germs of these two diseases into the human system. Of course no rule is without its exceptions, but it may be broadly stated that the typhoid germ is swallowed either in food or drink, oftenest in water, and flourishes and commits its most noticeable ravages in the digestive tract or alimentary canal; while the diphtheritic germ is inhaled, and flourishes and commits its ravages in the respiratory tract, the nostrils, fauces, larynx, windpipe and bronchial tubes.

I had the honor in the spring of 1878 to deliver the "Address in Hygiene," before the medical society of this State, in the city of Pittsburgh. That city had just been passing through a most mournful experience in an epidemic of the latter disease, and I felt that the occasion ought to be improved.

A better text from which to preach a sanitary sermon no hygienist could have desired. Following the hint of Shakespeare's sagacious observer who found "tongues in trees, sermons in stones, books in running brooks, and good in everything," it was an easy matter to read a homily from the four hundred little white headstones which marked four hundred new made graves on the beautiful hillside above the bank of the rushing river, just outside the city; it required little imagination to hear the leaves whispering together in the night wind a sad requiem over those four hundred little mounds, green with the grass of their first summer; and no imagination whatever to perceive that beneath our feet, as we walked the streets of that busy town, were running, through tortuous subterranean courses, noxious streams, whose pestilential exhalations would prove, as they had proved, messages of death to many a household. The "good" which we were to look for here was to be found in a fresh opportunity to educate the public mind and quicken the official conscience in regard to the sin of filthiness.

The mind that can carefully peruse this plain recital and consider it in connection with the excellent map which Dr. Snively, the efficient registrar of vital statistics of that city, has been good enough to furnish me to illustrate it, and fail to be convinced that sewer air will cause diphtheria, could not comprehend the simplest proposition in mathematics

The circumstances which give this epidemic its special importance as an educator and an illustration are its intensity, the rapidity of its

rise, its restricted localization, and the proved existence of insanitary local conditions together with unusual meteorological exciting causes.

Sanitarians are often perplexed in their efforts to follow up a chain of evidence by finding this or that link missing, which, although not needed to satisfy themselves, is essential to convince an unbeliever. In this case none are wanting.

The intensity of the outbreak may be appreciated when I say that the city of Philadelphia, with a population six times as large, has never had so many deaths from this disease within a corresponding space of time.

As to the rapidity of its rise, its mortality ran up from zero in June, to ninety-two in August, and two hundred and sixty-seven in October.

For such a startling increase in the prevalence of a single disease some remarkable cause must have existed. The board of health set itself to work to discover this cause, and if possible to counteract it. The thoroughness of their investigation might well be imitated in some larger centers of population, in which equally combustible elements are only awaiting the spark which shall kindle them into a wide-spread conflagration. "Except ye reform ye shall all likewise perish."

As to the local conditions, distribution of the disease, and exciting causes. I now gladly allow Dr. Snively to speak.

"During the seven months immediately preceding the outbreak," he says, "there were certified from widely-separated and remote parts of the city only 35 deaths from diphtheria, distributed according to season as follows:

"January, 9; February, 3; March, 4; April, 3; May, 5; June, 3, and July 8. These were distributed topographically as follows: East-end wards, 8; Old city wards, 12; South-side wards, 15. Of the 15 deaths which occurred upon the South-side, but four were located in what we may appropriately designate (in the light of subsequent events) as the *infected district*, viz: These portions of the Twenty-sixth, Twenty-seventh, Twenty-eighth and Twenty-ninth wards, located contiguous to, or drained by, the Washington street and the Twentieth street sewers. The record for the month of August shows 61 deaths, of which number 43 occurred in the infected district, while of the 465 deaths which occurred during the eight months from August 1, 1877, to April 1, 1878, 174 were located within the limits of the infected district.

"The territory to which I have applied this title is ninety acres in extent and triangular in shape, being bounded by Carson street, Twenty-first street and the base of the hill which rises abruptly to an average height of 450 feet above low water mark in the river. Carson street, which may be considered to represent the average level of the district, is 60 feet above low water mark. Owing to the fact that the streets running parallel with the river, are, as a rule, ex-

ceedingly level, the sewers which traverse them are of very low grade.

"In this district, during the month of August, 1877, diphtheria suddenly began to prevail in a manner to attract attention, and in a very short time threatened to assume the proportions of an epidemic. As previously stated, the deaths in this district during the first month of the outbreak numbered forty-three. Estimating one death to every five cases, there must have occurred to produce such a result over two hundred cases.

"The evidence is strongly presumptive, that in the sewers, particularly the one traversing Washington street, in which a solid mass of filth from one to three feet in depth had accumulated, the specific poison, or whatever you choose to call it, which produces the disease known as diphtheria, had found a lodgment and a favorable soil for its development and multiplication. To the local sewers, undoubtedly, was due the fact that the disease selected this district as its habitat, and from this locality as a center, radiated, presumably by virtue of its contagious properties, in every direction.

"The first cases occurred in immediate proximity to the Washington street sewer. This sewer, including its branches, is a little over a mile and a half in length. That portion of it running from Tenth to Seventeenth street was built in 1851. In 1866 it was extended to the river. Beginning at the foot of Eighth street its main stem traverses that street to its intersection with Carson, from this point it passes diagonally through private property to the intersection of Ninth and Washington, and from this point traverses Washington to Seventeenth street. It is constructed of brick with five feet internal diameter from its mouth to Twelfth street, four feet in diameter from Twelfth to Fourteenth street, and two feet ten inches in diameter from Fourteenth to its terminus at Seventeenth street. The average grade of the main line of this sewer is said to be one foot per hundred. Judged by the grade of Washington street from Ninth to Seventeenth it must be considerably less in this part of its course. It has twenty-nine street drops, *none of which are trapped*, the emanations therefrom being a source of great complaint. The refuse from a slaughter-house drains into the drop at the corner of Washington and Eleventh streets. At the time of the outbreak of diphtheria this sewer had not been cleaned since its construction in 1851—a period of twenty-six years—and, as previously stated, was 'choked' throughout the greater part of its course with a mass of filth from one to three feet in depth."

So much for the Washington street sewer and its high capabilities as a contagion breeder. Let us now follow Dr. Snively in his examination of the other "running brook."

"Following closely upon the development of the disease along the Washington street sewer and its branches, a similar development occurred among the more elevated branches of the Twentieth street

sewer, so that the outbreak may be said to have been simultaneous throughout the infected district.

"The Twentieth street sewer, including its branches, is about two and a half miles in length and was built in 1867. Its main stem is constructed of brick, with six feet internal diameter. Its main branches are also constructed of brick, having diameter five, four and three feet. A pipe sewer four feet in diameter—being a continuation of the Eighteenth street branch—extends a distance of two hundred and seventy-five feet up the steep hillside to Pius street. This sewer would appear to have acted as a chimney or ventilator for those on the flat ground below, as the deaths were most numerous in the immediate vicinity of its terminus."

Thus the poor wretches who supposed that by taking up their abodes upon high ground they were going to insure themselves a healthy location, in consequence of their own ignorance of the simplest laws of physics, and the worse than ignorance of their constituted authorities, were only choosing a spot where the deadly infection might most surely reach them. "The remaining branches are constructed of fifteen-inch pipe. This sewer has a good grade with the exception of those branches which traverse the streets running parallel with the river The street drops connected with it are provided with traps with the exception of seven on Twenty-first street, which are a source of much complaint because of offensive emanations. About a dozen slaughter-houses are located near its terminus on Twenty-first street, the refuse from which is conveyed by it to the river."

As showing how carelessness and ignorance may convert that which should be an aid to sanitation into a positive instrument of atmospheric poisoning, it is alleged that the drops were also constantly becoming offensive, owing to the fact that people ignorantly threw stale eggs, vegetables and all sorts of material into the drop, the most convenient place of deposit, under the delusion that they would in some way or other get into the sewer and be carried away. It will be readily seen that from this cause the drop and not the sewer may often be the true source of offensive emanations.

"Both the Washington and Twentieth street sewers are without systematic provision for ventilation. Man holes are provided at intervals, but are covered with tight fitting cast-iron lids."

The existence of fearfully insanitary conditions in the city of Pittsburgh previous to the outbreak of diphtheria is thus clearly shown. But these conditions were evidently no new thing. They had existed for years back, only growing each year in intensity and lethal power. To what are we to attribute their sudden passage from the passive to the active condition? What was the spark which exploded the mine? The explanation of Dr. Snively given below is undoubtedly the correct one. It has a special significance for those of us who live in Philadelphia. There are large sections of this city in which, during sum-

mer storms of the slightest severity, the sewers not only refuse to perform their ordinary duty of carrying off the rain-fall but vomit forth their stinking contents until the streets are, for squares, flooded knee deep. What must the effect of this pressure be upon the traps of houses on a higher level. I venture to say that there are few houses in the city in which, with a strong south-east wind and a high tide, one or more traps are not forced in the manner indicated.

"In cities which drain into tidewater," says Mr. Edward S. Philbrick in the *Plumber*, "the outfalls of the sewers are generally covered at high water, either every day or at spring tides. If the ends have no gates the tide enters and fills the sewer as far back as its level allows. If gates exist they shut with the flow of the tide and sewage accumulates behind them with a result often almost exactly similar to what would occur without gates. In either case a large volume of air is driven up from the outfall towards the ramification of the system by every flood tide which covers the mouth of the sewer, only to be drawn back again when the ebb tide allows the sewer to empty itself. If this air does not communicate freely with the outer air a pressure of several feet of water must necessarily result, alternating the vacuum to the same amount every twelve hours.

"Large variations of pressure inside the sewers may also arise from the variable quantity of sewage flowing in them. Nearly all the sewage is discharged from the houses during the hours of daylight, the flow during the night being very small in comparison. Hence a periodic increase and decrease of the amount of air space within the sewers, dependent upon and varying inversely with the amount of sewage flowing. This is particularly noticeable among manufacturing establishments, where much water is used during working hours, and which do no not run during the night. Of course, the air must leave the space to make room for the sewage in the morning, and, as the flow of sewage diminishes in the evening, the outer air crowds in to fill the vacuum by whatever openings or ducts are most available."

Dr. Snively remarks—

"Sewers will always be dangerous enemies in our midst, until the sanitary engineers show us how to ventilate them, until this be successfully accomplished, the residents possessing sewer connections, will be compelled, in order to protect their health and lives, to resort to traps. These, in whatever manner constructed, may, under certain circumstances, be unreliable. During a heavy rainfall, the sewers are filled with water. The gas must therefore be displaced, and as the man-hole covers are tight, and the street-drops, already trapped, are rendered still more secure at this time, by the floods of water pouring through them, it must of necessity blow out the weaker traps in the house connections and enter the dwellings.

"It is exceedingly probable, that to a series of events of this char-

acter, was due the outbreak of diphtheria among the South-side sewers, which we are considering.

"The records of the signal office for the year 1877, show that prior to July 2, there occurred no heavy rainfall, or sudden and violent rain storm, of short duration but sufficient to fill the sewers. During the night of July 2, rain fell to the amount of 1½ inches in seven and a half hours. This was equal to 20-100 inch per hour, and must have poured an immense volume of water into the sewers. During the afternoon of July 27, there occurred a rainfall of 50-100 inch in a storm of one hour's duration—sufficient to test their utmost capacity." This would cause violent surface flooding of short duration. Its effect upon the sewers may be inferred from the fact that the velocity, force, and volume of water was sufficiently great to sweep a man, who was engaged in cleaning the Twentieth street sewer, a distance of 850 feet into the river. "This disturbance of the sewers preceded by but a few days the outbreak of diphtheria. On August 12, rain fell to the amount of 40-100 inch in a storm of thirty-three minutes' duration. Again, on August 15, rain fell to the amount of 60 100 in sixty-five minutes. We find, therefore, that there occurred during the year 1877, *one* heavy rain-fall, and *three* sudden and violent rain storms of short duration, but amply sufficient on each occasion, to cause an immense volume of water to be discharged from the hill-side into the sewers; the effect of which, as previously described, would be to force the sewer gas through the connections and into the dwellings. The date of occurrence of these four disturbing events, *coincides* to say the least, in a very suspicious manner, with the outbreak of diphtheria in this locality."

It is claimed by many sanitarians that the plan adopted in Pittsburgh, and in most of our cities of making the sewer, also the carrier of storm water is a mistaken one. One ground for this opinion is that just expressed so clearly and forcibly in the last quotation. The other, or one other, is that the sewer must be made very much larger than its legitimate object demands, and hence be comparatively empty, except during storms, thus affording an opportunity for the deposit of solid material in its course from want of force of flow to flush it. The above history seems to be strongly confirmatory of this view.

Such being the facts with regard to the danger of imperfectly protected sewer connections, is it not almost inconceivable that individuals could be found sufficiently reckless to omit all precautions whatever in forming such connections? And yet we are told that the testimony of the street commissioners was, that but a small proportion of the property owners possessing sewer connections had been at the trouble or expense of providing them with proper traps and ventilators. Upon this subject, also, Dr. Thomas, in his report to the Board

of Health, says: "The first, and a majority of the cases of diphtheria seen by me, were in close proximity to the Washington street sewer and its connections. This sewer is so badly constructed as to be a propagator of disease. A great error committed by landlords along Washington street and the side streets, is the connecting of cellars, water-closets, and cesspools with the sewers without the addition of traps or ventilators. So long as this condition of affairs exists, we must expect, and will have, 'germ' diseases."

Not without its mournful basis of truth was the old superstition which tenanted the caves of the earth with foul dragons ever on the watch to seize, and wrap in their loathsome folds, the unwary mortal who ventured within reach of their pestilential breath, even stealing, under the cover of night, into human habitations, and stupefying sleeping victims with their noxious exhalations, until they fell easy victims to their rapacity. Under every home, in every city, lies such a cavern, filled with like noisome beasts. "Eternal vigilance is the price of safety" from their insidious approaches.

I would that I could burn the red dots upon this map, every one of which is a house of mourning, as with an indelible brand into the brain of every one who looks upon it, so that ever afterward, when the word diphtheria met his gaze or fell upon his ear, the course of these serpentine sewers thickly clustered with their fruitage of death, might start into relief before his mind's eye, and the thought of sewer-poison instantly be present with him.

XV. The Hygiene of Old Age.

By H. C. WOOD, M. D., *of Philadelphia.*

Professor of Materia Medica and Therapeutics in the University of Pennsylvania.

Within a few weeks the city of Philadelphia has been called upon to mourn the loss of the man who, although very far from intellectually the greatest within her borders, as a citizen was preëminently chief. Dying at the age of eighty or eighty-one years, he is universally spoken of as being gathered like a ripened sheaf; yet, within a week of his burial, he was full of mental and physical vigor, and his death at the time was as unnecessary and avoidable as though he had only reached threescore years. A very notable percentage of the deaths of persons who have been successful in life, and have attained beyond the seventieth year, could be, by proper care, long postponed. Failure in life in a large proportion of cases saps vitality, and the man who carries the load of self-knowledge of such failure lives under a persistent strain, whose effects, though usually not recognized, are none the less

irresistible. In order to protract an advanced life it is well to understand not only the dangers that beset such life, but the reason why old age has been attained.

The humorist is greatest when underlying his rollicking is the lesson of a great truth; but perhaps few readers, when they enjoyed the broad fun of the "One-Horse Shay," as portrayed by our inimitable Holmes, have recognized the fact that the man who reaches old age does so largely because he has been constructed upon the principles of the famous vehicle "that ran for a hundred years and a day."

Barring accidental deaths from railroad collisions, typhoid fevers, lightning strokes, and other more or less preventable causes, the man who is so built that he is equally strong in all his parts, lives out his appointed days.

Excessive strength in one part is a veritable source of danger. The athlete perishes because his over-developed muscular system perpetually strains and finally wears out a heart or a lung that was originally constructed for a muscular apparatus of half the power of that which he has artificially built up. The larger proportion of mankind die early on account of some local weakness. It ought to be generally recognized that human age is not to be counted by years, and that in some constitutions the general tissues are older at fifty than they are in other individuals at one hundred. Many of the cases of so-called neurasthenia, or nervous exhaustion, of men and women suddenly or gradually breaking down at forty or fifty, ostensibly from over-work, are really cases of premature old age, and are to be nursed and treated precisely as other individuals would be who had reached to fourscore years. Moreover, a larger proportion of early deaths are the result of some vital organ being originally endowed with a longevity less than that of the rest of the organism.

The reason that consumption is so often utterly irremediable is to be found in the fact that in not a few cases the lung has reached its allotted term of days, and must die because its vitality is exhausted. If an eye, or other not vital part, fails from lack of vital power, the man exists; but if a lung dies, he perishes.

The result of these lucubrations is to lead us to this point, namely, that the individual who enjoys fair health at seventy-five years of age has probably been built upon the principle of the "One-Horse Shay," and that he should be treated as a wise man would treat such a venerable instrument of progression. He would certainly keep it off Philadelphia cobble stones, and allow it only to be bowled along some smooth turnpike, and especially would he avoid all jolts and jars which would throw an unexpected strain upon one part. The principle involved in such case is that which is most vital in the treatment of the old,—protection, and especially protection from strain of any one vital part. An old man exposes himself to inclement weather, and especially to a high wind, which suddenly drives the blood from

the surface upon the internal organs, and at the same time by its very force checks the enfeebled movements of respiration, which aid in forcing the blood out from those organs. As a result, the man perishes at once, because he has thrown too great a strain upon a weak heart, or, if able to momentarily resist the strain, dies in a few days of pneumonia, due to the congestion of the lung. I have known the sudden shock of good news to strike the old man down, as fatally as the pole-axe fells the bullock, by causing the blood to rush with renewed force through the brain, and tear its way through the weakened walls of the blood-vessels. Again, the violent emotion of a sudden bad news may overwhelm a heart which, with care, would have sufficed for its duties for many years. The young athlete in the boat race pulls at his oar until he drops from heart-strain, and, if the heart-strain has not been too severe, recovers himself in a few weeks, because the vital elasticity of the heart-tissues is in highest vigor. But the enfeebled and brittle heart-muscle of the old man, strained in some hurried effort to catch a railroad train, or in some equally unreasonable procedure, has no power of recovery, and rests itself only in death. What is true in regard to the healthy ordinary conditions of the old man is more abundantly true in regard to the diseases of the old. Medicines that perturbate—measures that bring relief through violent local actions cannot be borne, and are not to be employed. At the same time, when possible, it is most essential to arrest at once any incipient disorder in the aged. I knew an old doctor, renowned in all lands, who lived ten years beyond the period attained before by any one of his name, largely because, knowing himself thoroughly, every few weeks he arrested in its inception an attack, which, in a few hours, might have gathered fatal force.

I feel some hesitation in attempting to point out in detail the application of the principles which have just been enunciated, lest this paper may fall into the hands of aged persons, and be substituted for a careful consideration of their individual cases by some skilful medical practitioner.

Every person, when he advances in years, should go over his whole methods of life and personal habits with some wise counsellor, and should adapt his mode of life to the peculiarities of his individual case.

With this warning, it is probably safe to briefly point out some of the more important details in the regulation of the life of old people. The first question is in regard to food. The teeth in old age are, of course, lost, and they should, unless under exceptional circumstances, be replaced by artificial teeth, for the thorough chewing of food is even more necessary in the old man than in the young, because in the old the digestive powers are apt to fail. With the best artificial teeth mastication is apt to be imperfectly performed ; hence the food of the aged should be soft and readily comminuted, and especially should it be of easy digestion. Very few old people need stimulating

diet; very many are injured by an excess of nitrogenous food. The kidneys, like all other organs, are feeble, and, if meats and other rich foods are used in excess, they greatly increase the strain upon these organs. Milk and milk products, or preparations of breadstuffs cooked with milk, should form a very large proportion of the food of the ordinary aged individual; but individual peculiarities differ so much that personal medical counsel should in all cases be taken, so that the diet may be regulated to the needs of the individual case. Very many old people are hurt by the use of food in excessive quantity; but little exercise can be taken, all growth has ceased, and the bodily furnaces which make heat are able to destroy but very little of food fuel. Some little time since I had occasion to lecture on this subject at the Philadelphia Hospital, and an assertion that I then made that most old people are more comfortable, enjoy better health and probably live longer for the use of wine, has met with very severe disapprobation at the hands of some of the profession, whose strong sympathy with the temperance movement dominates their judgment. No valid reasons have, however, so far as my judgment goes, been brought forward to lead me to change my opinion. In the overfed American people the habitual use of wine during youthful or middle age and vigorous health is, we think, an injury rather than a good; but when the powers of life are failing, when digestion is weak and the multitudinous small ills of feebleness perplex and annoy, one or two glasses of generous wine at dinner aid digestion, quiet for the time being much nervous irritation, and in no way do harm. The sum total of ruin wrought by alcohol in the world is appalling, but it is not lessened by our shutting our eyes to the good that wine properly used may achieve. When in the aged there is a distinct failure of vital power, and especially of digestive power, the call for the habitual use of alcoholic liquors is, in my opinion, imperative. The danger of the formation of any evil habits when a man has crossed the line of seventy is so slight that the most conscientious physician need not hesitate in recommending the daily use of alcoholic beverages to his patient.

It is, perhaps, not universally recognized that in numerous cases of various character death finally is due, in greater or less measure, to cold and to an absolute failure on the part of the body to keep itself warm. In the old the heat-making functions are exceedingly low, and hence it is that few old people are comfortable in a room whose temperature is less than 80°. It is especially important, therefore, that an abundance of clothes be worn by old people; but the very weight of the clothes oppresses, so that it is important that lightness of material should be combined with warmth. There is no ordinary garment which compares in heat-preserving powers with the buckskin jacket, and, in our climate, every man who passes the seventieth year should furnish himself with such covering. At first the jacket

should be only worn when going out of doors; but in very advanced age it should form a part of the habitual underwear. The jacket should be high up in the neck and long in the sleeves, and should be of such a length as to thoroughly cover the abdomen. If worn as an under-jacket it should be perforated so as to allow the escape of the vaporous emanations from the body. Whenever there is any tendency to abdominal weakness, in addition to the jacket and the ordinary warm underclothes, an abdominal flannel bandage should be worn. It ought not to be forgotten that the mass of blood of the human body is in the abdominal organs, and that this is especially so when the circulation is sluggish. It is affirmed by authority that after death all the blood in the body can be put in the relaxed abdominal vessels; hence the importance of maintaining the abdominal warmth, and hence, also, the good effect in feeble people with pendulous bellies, of the bandage, which helps to sustain the relaxed vessels, and thereby maintain the general circulation. The mechanical effects of tight abdominal bandages are well understood by the profession in the treatment of ascites. It is well known that the sudden removal of the fluid by tapping over the abdominal cavity takes away so much pressure from the abdominal vessels as to cause them to relax and draw the blood away from the heart and lungs and brain in sufficient quantity to produce fainting. It is to prevent this that the patient about to be tapped is bound up, and the bandage continually tightened as the water flows off. The importance of the habitual abdominal bandage is, perhaps, no less although not as universally recognized.

XVI. Our Drugs and Medicines.

By L. WOLFF, M. D.

President of the Philadelphia Pharmaceutical Examining Board, Demonstrator of Chemistry, Jefferson Medical College, etc.

The use of pure drugs and medicines, properly compounded and administered, constitutes a most important feature for the preservation of health and the prevention of avoidable death. In all civilized countries it has been made the duty of the State to control and supervise this through competent officials and special laws. The harm arising from inert or impure drugs consists not only in defeating the end and object they are intended for, by admitting of the unchecked progress of disease and the fatal consequences thereof, but also in their improper and poisonous admixtures which make them destructive to life and health. Many of them possess powerful and toxic action, and consequently when compounded and administered in improper quantities and doses often give rise to most disastrous results.

That there are annually a number of valuable lives sacrificed from this cause is as little to be doubted as that all the cases of suffering, illness, and death therefrom are certainly avoidable by proper knowledge, forethought, precaution, and legal supervision. The persons who cause the deplorable accidents with drugs and medicines, though to be pitied for their participation in such sad catastrophies, are in the most instances culpable of criminal neglect, for none of these cases can be classed as unavoidable accidents, as with proper forethought by individuals and communities they might certainly be obviated. It is the duty of the State not to leave the measures and safeguards against such dangers to individual discretion any more than to leave the measures for protection of railroad crossings or the escape from fire of overcrowded buildings to individuals or companies controlling them. The duty of the government in this respect should be in two directions: First, to insure the importation and manufacture of pure drugs and medicines only; and secondly, to provide for their distribution in a manner that will secure to the individual freedom of danger from that source and the full benefit thereof intended for him.

How this is accomplished so far with us can be gleaned from the present system in vogue. All drugs and medicines imported from other countries are subject to examinations before passing the custom house by the government drug inspectors, appointed for this purpose. If found impure, deteriorated, or of inferior quality, they are either returned to the shippers or destroyed. After leaving the custom house these goods, the majority of which are of a poisonous nature, pass into the hands of the importers, wholesale dealers and manufactures, by whom in turn they are disposed of or manufactured into other compounds, extracts, or alkaloids. How successful drug inspections are carried on at the custom house depends largely on the specific knowledge of the drug inspectors, who are presumed to be well fitted for their positions, capable of conducting qualitative and quantitative analyses, and experts in the macroscopic and microscopic examination of drugs in pharmocognosy. After the government inspector passes the drugs, medicines, and chemicals, the State exercises no further control over them, nor is there any record of their distribution. A great many of the chemicals consumed in this country are manufactured in this city on a large scale, and it may be said, to the credit of our manufactures, of exceptional purity and reliability. That this, however, is due more to the high character of the members composing our manufacturing firms than to the precautions adopted by the State is also true. No provision is made that the men employed in such establishments possess sufficient education and special skill to prevent errors of serious consequence. None of our wholesale drug merchants and brokers are obliged to show professional skill or knowledge nor is this required of their assistants. Still, many of these firms not alone sell at wholesale but supply also consumers directly,

and that grave mistakes often arise from this source is scarcely to be wondered at. The would-be poisoner has less trouble to procure a pound or more of arsenic than a few grains, and he has in that manner the advantage besides of not being tracked in his transactions by a poison register. Whoever has noticed the careless manner in which packages of poison are stored promiscuously with those of food products, or other substances intended for large consumption, can only wonder that wholesale poisoning is not of more frequent occurrence. The textile colorer and dyer, the dye manufacturer, and other artisans use these poisons in immense quantities, to be handled by ignorant persons, who permit the residues to run into our rivers, and there to pollute the water we drink every day. Our common carriers make no distinction in handling poisons, and the package of arsenic may be stored along side of flour, sugar, salt, or other foods, only necessitating shaking of the car or the breaking of a package to produce a disaster so terrible in effect that everybody would condemn the government that permitted such practice, when by the simplest precautions accidents of such kinds might have been avoided.

But the loose manner of handling and distributing poisons is not the only danger to public health. Every day thousands of parcels of medicinal agents are sent to the bedside of suffering patients, who await them with expectations of relief from suffering as the sacred gift of nature, upon which their recovery, and with it prosperity and welfare to themselves and their family depends. Can we deny that every day in at least one or more instances, these expectations are defeated by the carelessness, neglect and incompetence of the person whose duty it is to supply them in accordance with certain regulations, laws, and of a certain standard?

The great State of Pennsylvania, the cradle of American pharmacy, is to-day one of the few States of the Union which does not protect her citizens by a law regulating the sale of drugs, medicines and poisons. You may leave this city to travel into the interior of the State, be taken ill there, and your medicines may be dispensed to you by the ignorant youth, raw from the pastures or by the cunning villain, who considers drugs and medicines a profitable investment in the measure that their substance is diluted or they themselves substituted by articles of less value.

Still our legislative body has never seen fit to pass any of the pharmacy acts that were from time to time presented to them. While it is true that we have the best school of pharmacy of the country in this city, nothing is done as far as the State is concerned to compel those that expect to practice pharmacy to avail themselves of its teachings.

The time is probably well within recollection of those here assembled, when fatal cases of poisoning from neglect and ignorance or incompetent drug clerks filled periodically the columns of our daily

papers. To such an extent did this prevail, that at last a special act regulating the practice of pharmacy and the sale of medicines, drugs and poisons in the city of Philadelphia was passed by the Legislature in 1872. This law, incomplete and faulty as it is, has acted so well, that since then no fatal case of poisoning from ignorance has been recorded. The green youngster and incompetent clerk who by mercenary employers had the lives of the public at his mercy, has made way to educated and intelligent assistants. As a consequence I think that to-day, with but few exceptions, you can trust your life safely to the skill of Philadelphia pharmacists and their representatives. But, while I would state here that there is no more painstaking, intelligent, and better educated set of pharmacists anywhere than in this city, there are nevertheless a few amongst them whom the law cannot reach, and who carry on their business for which they are not fitted openly and in defiance of the authorities. That this is so is the fault of the construction of our pharmacy act, and works injustice in several ways. Those of you who are able to pay fair prices and go to respectable establishments can be assured of pure drugs and accurate dispensing; but is the State not also bound to protect the poor who are led by dire necessity to seek cheap shops where quality is made to suit the price, and where no qualified persons are employed to to compound? Many a poor ignorant colored man still pays his hard earned money to the Voodoo doctor for charms of various kinds. The herb doctor's shop flourishes in many of our thoroughfares; and the pseudo-Indian herb doctor with his attractive Indian show and flaring advertisements deludes the masses to purchase his worthless wares.

The patent medicine vendor still holds his sway and openly defrauds the ignorant. By the power of the capital he controls he has the sympathy of the press, which he patronizes freely, and so defeats the ends of justice with disregard of law, and obtains protection for his trade from legislative bodies. While the pharmacist is required to possess sufficient skill, qualification and education, these incompetent quacks, with their cure-alls, have the right to endanger public health without restriction. The very fact that their remedies were originated by ignorant persons is often set forth as an argument to their advantage, and that they are still compounded by persons of the same stamp, who have no intimate knowledge of the articles they are handling is only too true. That many of these remedies are not even advantageously applied for the diseases they are recommended for is but the least to be said against them. Many of them contain deadly poisons which, as in some of the soothing syrups for children, often do harm and certainly retard and stunt the growth and development of our race.

If nostra and patent medicines we must have, let the law prescribe that they shall be prepared by qualified persons alone, and sold only by

such, to prevent their improper application. It seems a slur on the intelligence of our people that two-thirds of the money value expended for medicines should go toward the purchase of patent medicines. Just think of it! That two-thirds of all the money the people expend for medicines is wasted for stuff, of which perhaps the best that can be said is that it is utterly useless, while a great deal of it is certainly not adapted for the diseases they are recommended for, and a large portion of them do actual harm. They are probably all more or less frauds and delusions from the various bitters which offer but an excuse for tippling—the blood purifiers which are relics of a past age with its humero-pathology—to the more recent devices cunningly constructed so that by the use of irritant oils they should simulate electric or galvanic effect. To say that at least two thirds of all the money expended for medicines is actually wasted would be of little consequence in comparison to the harm done by it.

The promiscuous use of medicines is no longer considered medical practice, and the therapeutist without diagnostic skill is more to be feared than the diagnostician without remedial agents. Still the blatant quack assures us of his power of curing diseases of which he does not know the first thing, or which he could not recognize if they were brought before him. They belittle the efforts of the medical profession who derive their knowledge from the experience of hundreds of years, and the application of natural sciences to the study of disease, and are certainly honest in their endeavors, while the nostrum vendor, the creature of a day, has but one end in view, the filling of his pocket. The intelligent member of society can discriminate for himself, but those who have not been blessed with a higher education, the toilers of the soil and the workshop, deserve to be protected by the State from cunning villains with designs upon their hard earnings in the hour of illness and dire distress, even more so than the citizen whose wealth is endangered by the pickpocket and the burglar. In older States and countries this has been recognized, and measures to that end have been enacted: Many of the European States entirely prohibit the sale of nostra, while in others they can be sold only when their composition is made known and tested. Can we ask less of our government than to restrict this growing abuse, or at least place it under control to prevent its harmful influence? The question arises, What can be done to accomplish this purpose? As already stated, from the moment of importation the State gives up all control of drugs, poisons and medicinal agents. Their proper elaboration by the manufacturer and middlemen can scarcely be enforced or controlled, but before they reach the consumer some measure ought to exist to protect the public.

In this Commonwealth there exist a few laws regarding the adulterations of food and medicines, but these are inefficient and with no provision for their enforcement. This latter seems to be the weak

point with all these laws. Their enforcement is everybody's business, and we all know well that what is everybody's business is nobody's business. Whoever heard of a prosecution under this act, although it is well known that there are special brands of grocer's cream of tartar containing 75 per cent. of foreign material, and that many of the spices contain sawdust and other inert, if not hurtful, substances, and so with many other articles of the same kind.

It is a common idea that the retail pharmacist is, to a large extent, guilty of adulteration, sophistication and substitution. In this city this was acted upon not long ago by one of our prominent daily papers; the result, however, showed but little proof for such assertions notwithstanding the courted investigation by the druggists themselves. Though this does exist with a few, it is generally the case with those who lack proper professional education and carry on this business contrary to the law. Education and knowledge brings with it a moral sense of responsibility and an endeavor to act right and honestly.

The result attending the enforcement of the pharmaceutical law of this city by the board of examiners for this purpose has greatly improved the moral condition of the retail drug business, until at this time the physician may safely send to any reputable drug store in the vicinity of his patient with the assurance of obtaining the proper remedies he desires, and the relief to his mind that any error or slip of his pen will be duly controlled and corrected by the pharmacist. The anxious parent need no longer tremble least the health giving potion to the invalid child should, by the error of an uneducated drug clerk, bring death and misery in their household. That there is a need and place for such supervision may be learned from the reports of the Pharmaceutical Examining Board, which states that 33 per cent. of all applicants for the certificate of qualified assistants were refused, and only 39 per cent. of all applicants for the proprietor's certificate had this granted to them. Still the Legislature of this State refused to give a similar law to the entire Commonwealth. It may be better surmised than stated what agencies have been at work to such an end. The grocer and dealer in general merchandise still sells without restraint arsenic, Paris green and other deadly poisons, which are kept over and alongside the sugar bin, while the laudanum bottle and the host of patent medicines go largely towards making up his stock in trade. Is the public benefited thereby? Is the loss of health and life annually arising from such loose practice offset by the slight gain of a few? Is the thriving trade of the cheap medicine vendor who, in opposition to all law and justice, incorporates everything and of the lowest quality in stock, an encouragement to the conscientious pharmacist, whose skill and moral responsibility is a guarantee for your life and health?

The inference is obvious. The State owes it as a duty to the public that it shall protect them from dishonest dealers in and compounders of medicine, and to the honest and competent pharmacist that it shall protect him from unfair and unlawful competition. The standard required should be high, the laws severe and their enforcement assured. While the local law of this city has done much toward improving the morale of pharmacists and protecting the public from incompetent men, it is still sadly deficient in its effect as long as it fails to bring all offenders to justice, and as long as it does not control the quality of drugs and medicines as well as the vendors and compounders.

The great Keystone State should no longer stand alone in its unenviable position as an asylum for the incompetent druggists and drug clerks of the country. The State Board of Health and all sanitarians should unite to urge the passage of a law which will secure for the public universally pure and reliable drugs, properly compounded by competent persons only. Many of the States have adopted such laws, which have proven as deficient as our own. Let us profit by their experience so as to insure for us measures which are sweeping in extent and safeguards in every respect against such sad catastrophies as have but recently in a neighboring State robbed two loving daughters from their fond parents.

What practical measures can be adopted with these objects in view? The competition of free commerce cannot be applied to such purpose. Restrictive laws alone can be protective. Let the sale of drugs, medicines and poisons be restricted to those alone that have fitted themselves for it and have amply proven their fitness. Drugs and compounds of powerful action should be classified by law and directed to be kept apart from others less active. They should be kept in locked receptacles, the keys to which should be held by the competent pharmacist and his qualified assistants alone, and should be opened only in presence of a witness to control their proper disposition. Not the retail druggist alone, but all those who deal in drugs, medicines or chemicals, either at wholesale or retail, should be included in this act and required to show competency, both in proprietor as well as in assistants. None others besides these should be allowed to deal in medicinal articles of any kind save the physician dispensing to his patients directly. The quality of all drugs and medicinal articles should come directly under the supervision of the State Board of Health, who should direct at least annual inspections of all establishments where medicines are sold. And lastly, the enforcement of such an act should be placed with the same board to whom all delinquencies should be reported by the inspectors of drugs, appointed by them, and also the examiners in pharmacy and others concerned therewith.

With such a law and thus enforced I have no hesitancy to say that the tales of the murderous drug clerk would be a thing of the past,

and drugs and medicines will prove as they are intended, health-giving instead of dangerous to public safety, and destructive to health and life.

XVII. On Continuous Preventive Disinfection of House Drainage.

By Henry Hartshorne, M. D, *of Philadelphia.*

The object of this convention is practical. We want, therefore, most of all, facts. But facts are only useful when so marshaled as to form intelligible conclusions, which can be applied in practice.

Facts concerning the prevention of infectious diseases are of several kinds: 1. Evidence as to the local and personal conditions under which those diseases occur, with greater or less violence, width of prevalence and fatality. 2. Scientific proof of the nature of the essential specific cause of each particular disease when such proof has been obtained. 3. Sanitary experience with the use of means to prevent or arrest the progress of diseases on a larger or smaller scale. 4. Scientific experimentation to ascertain the most effective agencies for the destruction of the specific causes of diseases when they are known.

Under two of these heads, allusion is intended to be made to the "theory of disease germs." I have long believed in the probability that some diseases are in some manner produced by minute organisms, microbes. In a lecture on cholera in our university in the summer course in 1866, I expressed the conviction that epidemic cholera must have such a specific cause. But the true scientific spirit requires close scrutiny of every asserted verification, even of a very probable theory. We believe, to use an illustration, that the anarchists now troubling our country are mostly comers from the continent of Europe. But it will not do, therefore, to arrest every Bohemian or Pole as soon as he arrives and dub him an anarchist. So I do not consider the evidence sufficient as yet to prove that either the comma bacillus of Koch, or the microbes of Emmerich, or of Finkler and Pryor, are the essential producing causes of cholera. It is quite possible, indeed, that the microbes, the minute organisms, which are the specific causes of some diseases, or at least their spores are, *ultra-microscopic;* too small to be discovered by the highest power yet reached, or likely to be reached, by the microscope.

Such inquiries ought, of course, to be zealously persevered with, and their results carefully appreciated. And this is equally true of experiments for the destruction of microbes by powerful chemical or other agents. Such experiments have been made by many able scientists in this country and Europe. Excellent work of that kind has been done and reported upon within the past year by a commit

tee of the American Public Health Association. At the same time it is necessary here to emphasize the importance of also justly apprehending the other class of facts already named—those of sanitary experience with the actual use of means to prevent or arrest the progress of infectious diseases. Put together the well-attested results of this experience and those of scientific experimentation in regard to the discovery and destruction of microbes or disease-germs, and we have a very safe and sound basis for sanitary practice.

Of actual experience in the prevention of disease by disinfection, Dr. O. W. Wight, health officer of Detroit, Michigan, reported an excellent example at the meeting of the American Public Health Association, at Washington, last December. Finding the sewerage of Detroit in a bad condition, with a great deal of mortality from diphtheria, scarlet fever and analogous diseases, he went to work vigorously; and, with the aid of citizens, put into the 200 miles of the city's sewers 275,000 pounds of sulphate of iron. He also burned in the sewer manholes, under cover, three tons of sulphur; the gas from which was found to pass freely through the whole drainage system of the town. In such close coincidence with this disinfection that it must be reasonably regarded as its effect, there followed a marked diminution in the number of cases of, and deaths from, diphtheria and scarlet fever; in fact, almost a total cessation of those diseases. Such results must be accepted as of positive practical value, notwithstanding the experiments which have made it appear that sulphate of iron is not efficacious in the direct destruction of bacteria, and that sulphurous acid gas is so only in very large amounts.

Abundance of similar evidence, though seldom so clear and full as Dr. Wight's, is familiar to sanitarians. Nor is there any difficulty in reconciling it with a full acceptance of the theory of disease-germs. If it be admitted that these are the actual and essential causes of infectious disorders, then, where they exist, the thing to do is to destroy them. But, in this as in every other case, prevention is better than cure. Starving out an enemy is as certain a measure of hostility as striking him down with cannon shot. While, then, there is a measure of plausibility in the assertion of the committee of the American Public Health Association that nothing ought to be said to be a disinfectant which does not destroy disease-germs, this assertion does not express or contain quite the whole truth upon the subject. This much is practically admitted in the committee's reports. Thus Dr. G. M. Sternberg, U. S. A., writes,* referring to the sulphates of iron, zinc, etc.: "The value of all these agents as antiseptics is beyond question, and when the object in view is to prevent the development of germs in privy-vaults, cesspools, etc.," they may be recommended. More than this, however, I would add, is to be said. How do "germs" act in producing diseases? This has not been demonstrated. Many authori-

* *Medical News*, August 22, 1885.

ties, among them the great bacteriologist, Dr. Robert Koch, believe it most probable that they act by generating poisonous materials, which are the direct disturbers of the health of the body and the causes of death. In a discussion at Washington in the American Surgical Association, so lately as April 29, 1886,* Dr. J. S. Billings referred to the poisonous alkaloids—*ptomaines*, and the more recently discovered *leucomaines*, formed in dead or diseased animal bodies; and then went on to say, that the only theory which we have at present to account for the evil consequences of the lower organisms in the body is, that much of their action depends not on their presence or immediate effects, but on the impression made on the nervous system by some production of the micro-organism; that is, some poison generated by it. Therefore we may hold it to be entirely possible for a chemical agent which will not, in any ordinary quantity or strength, destroy all bacteria, micrococci, or spirilla, yet to so antagonize or decompose the poisonous material which they produce, as to make them harmless. Moreover, there is truth and importance in the remark made by Dr. Formad at the close of yesterday morning's discussion in this convention: That "there may be organic matter, *independent of microbes*, which is dangerous to health." That there is such matter, capable of producing death as well as disease, is the well-founded conviction of many, probably of nearly all sanitarians.

The committee to whose valuable labors I have already referred, make the test of a perfect disinfectant, in the strictest scientific sense, to be the destruction not only of all microbes, but also of all spores. They state, however, that in the list of disease-germs which do not produce spores, there is good reason to include small-pox, cholera, yellow fever, diphtheria, erysipelas, puerperal fever and perhaps scarlet fever—a very important list. Also, Dr Sternberg, in his prize essay on disinfection,† just published, says, that as a general statement it is true, that a disinfectant for one kind of micro-organism is a disinfectant for all in the absence of spores. I quote another sentence from Dr. Sternberg's essay.‡ "We hasten to say that the combined experience of sanitarians, derived from practical efforts to restrict the extension of infectious diseases, is of the greatest value, and, that this experience is, to a great extent in accord with the results of exact experiments made in the laboratory."

Here, then, we have a clear and open ground for conclusions about practical disinfection. What is needed is, first, to destroy or purify all filth, which is always of unwholesome influence, and upon which disease-germs live and multiply. Secondly, when a disease-cause is actually present in a place, to destroy it, if possible, spores and all,

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* *Medical News*, May 8, 1886, p. 530.

† P. 107.

‡ P. 105.

or to render it powerless by chemical antagonism of the poisonous material it produces.

Many agents are more or less available for these objects. The next question is, how best to use them. Ordinarily, this has been done spasmodically; irregularly. Some one dies, perhaps, as happened so lamentably a few years ago in the family of the distinguished chemist, Dr. Doremus, of New York, from sewer air poisoning; and then for awhile after this the drainage is looked to, and a few pounds or quarts of some disinfectants are used. But this is not the right or the rational way. It ought to be done *all the time;* to be continuous. The difference is much like between the two ways of dealing with anarchists and mobs. One plan is to leave them alone until they come with their rifles, revolvers and bombs, ready to sack the town, and then bring a regiment of soldiers, or a Gatling gun or two, to mow them down. The other and more reasonable way is to have a good police watch kept on them all the time, and shut up and disarm every Most and Spies and Parsons as soon as they begin to show themselves. Thus, prevention with clubs and hand-cuffs will be shown to be better than attempted cure with bayonets and cannon-balls. The only proper aim, then, concerning diseases is *non-infection*, by the continuous preventive use of disinfectant materials in house-drains.

While pursuing my investigations on this subject, in which I have been interested for a quarter of a century, I have been delighted to find that this aim has been practically reached by a simple mechanical and chemical device now already in use in many thousand buildings, under the not very well chosen name of the germicide. I venture to speak here of this because I think it is not so well and generally known as it deserves to be for the public advantage. By this apparatus, which may be readily attached to any water-closet without interfering with the plumbing, a flow of a strong solution of chloride of zinc, at the rate of about sixty drops a minute, is made to enter the closet-bowl or hopper *all the time*, whether the closet is used or not, by night as well as by day. Under its action there can be no chance for fecal decomposition or infection to occur: It fully realizes preventive disinfection on the principles which I have in this paper been endeavoring to set forth. There is with it also an arrangement for introducing the vapor of thymol into the room as an aërial disinfectant. I will not occupy time by dwelling upon that part of the appartus, which I regard as secondary in importance, although, so far as it goes, of good intention and effect.

Thymol is a positive antiseptic, not merely an odorous substance, which, like eau de cologne, etc., merely covers up a bad odor with a less disagreeable one. Popular confidence in the disguising of foul smells, under a notion that it is disinfection, ought to be corrected. Moreover, it is important for it to be known that an atmosphere which

has no odor at all may be injurious, even dangerous to health. All foul smells are, it is true, to be suspected of having an unsanitary origin; and if, as by thymol vapor, we correct them, it is a benefit to the air in which they occur.

I speak the language of conviction when I apply terms of strong commendation to the chloride of zinc arrangement, called germicide, because it meets precisely and fully the theoretical requirements of preventive disinfection, and also it has been amply tested in practice in this and several other cities. Its beneficial action is affirmed by members of boards of health and other leading sanitarians in Washington, Cincinnati, New York, Boston, Baltimore, Chicago, San Francisco and Philadelphia. It has been in successful use for a considerable time in a number of our hospitals, and other public buildings, and in more than one thousand dwellings in this city.

An excellent place to see it on fair trial, which I have visited, is at the Brighton knitting mills of L. D. Cox & Co., at Eighth and Dauphin streets, where, I have been told, hundreds of bottles of Platt's chlorides were formerly used, in the ordinary way, with only partial and temporary effect, even in deodorization. Since the germicide *constant flow* system has been introduced there, the evil has been altogether corrected. In some factories the favorable influence of such a change on the general health of operatives has been very marked. In public school buildings, as an auxiliary to, or at least while waiting for, the somewhat elaborate method of heating and ventilation so well described here yesterday by Dr. Jefferis, it would undoubtedly be a great improvement upon the general neglect of the water-closet system in such institutions.

Chloride of zinc, according to the observations of the American Public Health Association Committee, in the proportion of five per cent. added to the material to be disinfected, can be relied on for the destruction of micro-organisms in the absence of spores. A twenty per cent. solution of it will destroy the vitality of the most resistant spores. By using Mallett's ingenious process, anhydrous zinc chloride is procured for germicide use in such a condition that water percolating through a mass of the zinc in small lumps or blocks makes a solution of very constant strength. This constancy has been carefully tested by S. P. Sharples, chemist and State assayer of Massachusetts. It does not act on lead or iron pipes. In the language of Dr. J. R. Nichols, editor of the Chemical News, it is to them "as harmless as a solution of comon soap." This could not be said of chloride of lime or corrosive sublimate in solution.

Forty or fifty gallons of water, I am told on inquiry of its makers, pass through this apparatus in a month, dissolving about three pounds of chloride of zinc; of the latter, therefore, nearly two ounces go through the closet and drain every twenty-four hours. Traps thus

treated can never be emptied, either by syphonage or by evaporation; and this is of itself a very great advatage.

A trap with no water in it worse than none. Nor will it do to place too much confidence in air-vents for traps. When only open above, no air may pass through them at all; and even when there is also an inlet below, the ventilation may be insufficient. The most intolerably offensive smells I ever encountered were, one, not a water-closet, but an open and uncleansed substitute for it, an air-hole in a passenger car on the New York Central railroad; and the other a neglected water-closet from which the water had evaporated away, in a dwelling whose usual occupants were absent for the summer. Water does much more than air for such uses, and water, armed with a good disinfectant, will do much more still.

Water traps have been shown, by Drs. F. H. Hamilton and Doremus and others, not to prevent absolutely the absorption of foul sewer air and its escape into the house above the water seal. It has even been found possible, by the observations of Professor Frankland, of London, and Dr. Paton and B. W. Thomas of the Microscopical Society of Chicago, for micro-organisms so to pass, and to enter the air at least when the water is agitated by bubbles of fermentation. I am not inclined to speak of these occurrences as more than possibilities; ordinarily they can hardly add much to the dangers of house drainage. But those dangers are bad enough, from the imperfection of plumbing in some instances, and from the perishable nature of materials even when the plumbing has been good, to make it of prime private and public necessity to avoid them.

As to the expense of the germicide method, I must refer to those in charge of its administration, with which I have no connection and have but little knowledge of it. The cost is, however, I know, moderate. Dr. Sternberg's estimate of the cost of the effective use of chloride of lime for house drainage is one cent daily for each person; of his "standard solution" of corrosive sublimate and permanganate of potassium, two cents daily for each person. The constant employment of the former (chloride of lime) in water-closets would be impracticable for cogent reasons; and so would be that of corrosive sublimate, while the cost of the first of these would be about as great, and of the latter at least twice, that of the germicide zinc solution. We are accustomed to pay a stated sum every year for our water supply; another amount for our gas, and another for our coal as fuel. Surely it is worth while to expend a little every month toward the effectual preservation of our health and that of our families, without which all other expenditures are vain.

A bill has been introduced into the New York Legislature providing that every factory or other large private or public building shall, in order for sanitary protection, be fitted with germicide fixtures. I

believe that if, in addition to the regulations for plumbing lately enacted by our Board of Health, there could be also one requiring every house to have a sewer-connected water closet instead of a privy well or cesspool, and obliging every water-closet in the city to have a germicide attachment, it would not only correct what Colonel Waring has so well called our "home-made sewer gas," but would make disease-infection and extension almost impossible among us. Typhoid fever would greatly diminish, diphtheria would become rare, and cholera, if it should again visit this country, would pass us by almost or quite unharmed. Utopian as this may seem, yet only by such really effective measures of prevention can Philadelphia long maintain the reputation of being one of the healthiest cities in the world.

XVIII. A Plea for more Prolonged Isolation in the Management of Scarlet Fever.

By W. W. Vinnedge, M. D., *of Lafayette, Indiana.*

It is taken for granted that we are all of one mind as to the desirability of imposing some artificial check on the spread of scarlet fever. Most of us are convinced that its only source of reproduction is an infecting material from the sick room conveyed in some way to the unaffected. All of us know that children are its chief victims, and, that it is a distressing and frequently a dangerous disease.

There is much diversity of opinion among public health officials as to how long a time scarlet fever patients should be isolated, and, whether in mild attacks of the disease, the cases should be isolated at all. Even among some physicians there is much uncertainty as to definite indications of the duration of infectiousness, and naturally the sick are frequently permitted to mingle with society too soon for public safety.

Few persons would hesitate to separate a child with sore throat, strawberry tongue, fine red rash, and a high temperature, from his companions or schoolmates, and to keep him carefully isolated through out the fever stage, and perhaps a little longer; but, during later convalescence, separation would, in many instances, be so uncertain and imperfect that it would have little if any value as a protection to the susceptible. In mild cases of the disease, not sufficiently marked to cause anxiety or to oblige the patient to be placed in bed, the parents would sometimes probably be unwilling to practice isolation, especially if the father's business might be injuriously affected by a publication of the disease in his family.

The welfare and safety of the family of the daily laborer who reads but few if any books during the year, requires, as far as possible, that he

be accurately informed as to the propagation of this disease, as well as have a practical knowledge of the means used for its prevention. He should be taught in simple language, that "in this disease as in small-pox, the poison is given off from the bodies of the sick, and is not reproduced independently of them,"* and that "it is propagated by a peculiar poison, which by reason of the tenacity with which it adheres to articles of clothing, and other peculiarities, we have good grounds for holding is a solid."† It should be made plain to the least informed that there is no knowledge of any means of protection against the spread of the malady other than isolation, cleanliness, and disinfection. Teachers in the schools should inform parents and pupils that it is not sufficient to isolate only the time of the fever stage,—or while the sick are confined to the bed or in-doors,—but that this means of prevention of the spread of the disorder should comprehend, in every case, all of the time from the beginning of the sore throat to the completion of the peeling process.

Frequent trustworthy reports of the spread of the infection having been traced to milk, admonish that dairymen and their families and employés be required by the authorities to practice greater cleanliness and a more prolonged isolation in the presence of this disease. Dairymen need instruction rather than discipline; they disregard the rules of public health from lack of sufficient information rather than from other reasons.

Since there is no knowlege of any means of protection against the dissemination of the infection, other than isolation and disinfection it is of the utmost importance that the intelligent use of these be well understood by the public.

It is not claimed that the period of infection of this disease can be determined by days or weeks, but it is believed that this can be determined with sufficient accuracy for sanitary purposes by the characteristics of the disease in its beginning and ending. The safe rule to be taught, particularly in the sick room, is that scarlet fever is contagious from the first appearance of the disease in the throat to the end of desquamation in the palms of the hands and the soles of the feet.

Since we have no prophylactic to hinder the spread of this disorder—as vaccination hinders small-pox,—its restriction is almost wholly a matter of intelligence and unselfishness.

In Indiana the public authorities cause a yellow flag to be hung up in a conspicuous place on every dwelling in which there is a case of this disease, as a friendly notice to warn all of the presence of danger. "Those who are associated with susceptible children have no right under any circumstances to visit the room of a scarlet fever patient, without taking the most thorough precautions with regard to

*Prize Essay, A. P. H. A., p. 133. † Bartholow.

the disinfection of their persons and clothing immediately upon leaving it, and even with these precautions such a visit cannot be justified when it is made simply out of curiosity or friendship."

It is believed that a good deal of apparent carelessness on the part of the public is due to a misapprehension as to the termination of convalescence from this disease. Many consider the cure complete and the danger past with the disappearance of the rash or fever, or both, and the return of the appetite and natural sleep. Medical writers and teachers do not, according to the information the writer has been able to obtain, define this point with the greatest clearness and certainty; at any rate it is believed that it would be better for purposes of sanitation if utterances in text books on the subject were more direct, explicit and simple.

It has been stated heretofore that the reason the parents frequently fail to prolong isolation sufficiently,—that is, throughout convalescence,—is the absence of disability on the part of the patient; for the same reason that isolation is declined doubtful or mild cases of the disease. This part of my subject can best be understood and illustrated by an example.

In an institution of learning near LaFayette, Indiana, attended during the past year by nearly four hundred young people of both sexes, an epidemic of scarlet fever made its appearance about midwinter. One can readily understand the anxiety felt by parents, teachers and trustees for the welfare of the pupils and the schoolwork. However, the president of the university, under the advice and direction of the county health officer, rigidly enforced isolation and cleanliness, and the disease soon yielded to management and disappeared quickly. Forty students were ill. About the time the affected were all convalescent, it was noticed that A— B—, a young man, a student, boarding and lodging outside the school buildings, had a sore throat, but was not sufficiently ill to prevent him from attending recitations, or for that matter doing any work. Although he was unwilling, it was thought best for him to absent himself from his class for a time, and he left school to take temporary lodgings with a neighboring physician. The doctor thought the ailment "simply sore throat, and in the absence of fever and rash not contagious." Unfortunately the physician had a family, and in less than a week after the introduction of the ailing student into his house, his servant girl was seized with scarlet fever. In a note to me, under date of May 7, 1886, the kind hearted-man briefly reports the case as follows:

"One severe case occurred in my family: An adult domestic, five days after exposure to one of the students who had previously roomed and boarded in Mrs. H——'s family, was seized violently with ulcerated and swelled throat, accompanied with the rash and fever. The disease was quite severe, and followed by a violent attack of acute

mania, which lasted about a week. She had albuminuria also, and became anemic, and was confined to her bed about three weeks, when convalescence began and complete recovery took place."

This case helps to strengthen the evidence as to the infectiousness of slight cases of scarlet fever, and at the same time invests doubtful cases of throat disease during an epidemic of the malady with a good degree of importance. In view of the foregoing case, and of similar ones that will arise in the minds of practitioners of medicine who have kindly read these statements, it is of the utmost importance to isolate slight and even doubtful or suspected cases of this deadly malady.

For the purpose of further study and to suggest discussion of this important subject, I beg, in conclusion, to advance the following propositions:

1. That the infectiousness of scarlet fever begins with the commencement of the redness and soreness of the throat, and ends with the completion of the stage of desquamation; and that the duration of infectiousness is variable, being often delayed in cases having mild beginnings.

2. That in a sanitary point of view, it is unwise to make any distinction between slight and severe cases in the management of the disorder. Contact in either case will surely expose the susceptible to suffering and danger, if it does not cause death.

3. That in order to prevent the dissemination of the infection, it is utterly wrong to permit any scarlatinal patient whatever to mingle with the susceptible until the completion of the stage of desquamation. As a rule the peeling process is completed at the end of the sixth week of the disease, but in cases in which exfoliation is of late appearance, convalescence is not complete at the end of the tenth, eleventh, and not always at the end of the thirteenth week.

XIX. What the State Owes to the People and the People to the State.

The Annual Address before the State Board of Health of Pennsylvania,

By the Hon. ERASTUS BROOKS, of *New York*,

Late a Member of the New York State Board of Health.

What the State owes to the people and the people to the State is, briefly condensed, the subject of my address. The two subjects in their conclusions are practically one and as closely knit together as a common object and interest can make them. The text is that "public health is public wealth and personal health the greatest blessing that God or man can give to country or mankind." To embrace this faith we are simply to believe for both State and people that "he is a freeman whom the truth makes free, and we are slaves beside."

The only authority I have for what I may say is from sources as open to those who hear me as to myself, and as a layman they are drawn from some experience in the State, not in what belongs to the great science of medicine, but to the common sense observations of a citizen of the State trying to serve the people as a State Commissioner of Health and once in places of trust in two of our National Health Associations. It has passed into a proverb that "virtue is its own reward," and in my case, as with thousands of others, the compensation, and no other is asked or would be accepted, is the satisfaction of trying to do some good, and no evil, to the State and to the country. So much every man who can, it seems to me, owes to the commonwealth of which he is a citizen.

All the time we are learning something in science and especially in medical science. In what belongs specially to micro-organisms there was never in the past so much general study and interest as at the present time. These organisms exist in the air, in the water, in the body, in plants, in the soil, and everywhere. I am glad to know that they have their good as well as their bad side. In the great economy of nature for example, these microbes, in the nitrogen they possess, contribute in plant-life and food-life to the benefit of mankind. We know but little at best of this germ life, of bacteria, germs, and the concealed organisms in everything that has real or apparent life. But we know enough to learn more. One fact is now recorded as certain that they may and do assist nature in the preservation of our lives and in the use of our food.

The First Great Object of Government

is the diffusion of knowledge and the enactment of laws for the regulation of States communities and persons; among the first of these duties are provisions of law for the safety of the people. To secure "life, liberty and the pursuit of happiness" is a principle of government older than the constitution, and as such was embodied in the first record of our national existence. It is safe, therefore, to say in the beginning of what we have to present that there can be no real life nor true happiness where the public health is not provided for by law; and that the State is only in the discharge of one of its first duties when it seeks, under reasonable laws, to maintain the chief end of its existence.

In the Congress of the United States, and in the Legislatures of States and territories, it is exceptional to find members of the medical profession. Here and there only, it is also true, are found men who unite an interest in the political and physical welfare of the State. In a certain way we all seek that "good digestion which waits on appetite," looking for "health on both." But far more than in what we eat and drink and put on and put off, we can digest our words, our thoughts, and living. Laws are digested and have been from the order of the

Roman Emperor Justinian, now nearly 1,400 years since, to the present time. In food for the body, as in light and air for the abodes of men, the work to be done is to arrange, classify, dissolve and distribute whatever in the one case is nutritious from whatever is otherwise; and in preparing whatever is put into the stomach for conversion into blood and into chyle or chyme; in the other case the work to be done is to arrange, classify, work over and distribute, for the use of others, whatever is necessary in books and letters for the instruction of mankind.

REDUCED MORTALITY AND GENERAL HEALTH.

To most physicians belongs the important duty which may be presented in the three aspects of reducing the mortality among the people, of saving the people from physical pain, and of curing the sick. If to do all this is not to make "a voyage of discovery" and "a circumnavigation of charity," then no such voyage can be taken in the journey of life. I know no work of equal value, nor any kind of labor calculated to promote so much human happiness.

In political governments the people are bound to seek and to enjoy, if they can, their political preferences for principles and persons. Whether in majorities or minorities one side will govern and the other side must obey. The two are essential to the welfare of the State; but while this is true there are in all States and communities, unities and necessities, more essential for the public good, and upon which there can be no safe divisions of opinion as to the proper uses of the authority of the State.

We may have diversities of opinion as to causes of disease, remedies for cure, as to climate and exposures, habits of living, the safety of buildings, the best methods of drainage, sewage, and ventilation in dwellings and work-shops; but science and experience will in time solve all these differences into some best practice or system, while in all that belongs to duty to be performed, or to neglect of duty commanded to be done in questions relating to the public health, there can safely be no divided counsels.

I place health as among the first, if not the first, in the science of political economy. It is a question which belongs to the wealth of the nation and to the prosperity of the people. The man or scientist who is capable of discovering or curing disease, and whom by custom we define as a physician, is in the established meaning of words, an experimentalist in physics and a natural philosopher. The doctor, in brief is a person recognized in law and practice, as one skilled in the art of healing the sick through the agency of proper medicines, and it is this healing of disease in its effect upon communities which covers and governs a material fact in political economy.

We know what ravages yellow fever has produced in this country and in the world, how many lives it has destroyed, how much misery

it has produced and distributed, how much wealth it has diminished. The lessening or removal of the prevalence of this calamity has been partly the work of physicians and a large share of it belongs to the nursing of liberal and intelligent men and women. This work, often a volunteer service, was inspired by the noblest motives, and has again and again, and especially in this section of the country, produced the grandest results.

The State politically, but not in the sense of party politics, and the people personally, in every sense I need not say, have the deepest interest in what is called State preventive medicine. Disease among a large class is often but another name for poverty, pauperism, orphanage and bankruptcy. In Philadelphia in 1871–72 some 4,500 people perished from small pox. The reported loss in business here at that time, and from this disease, was $16,000,000, besides a cash value in human lives of $5,000,000 more. New York city was also a great sufferer at the same time and from the same cause, while Baltimore, Boston and Providence and other cities resisted the disease and prospered greatly, owing to a timely and thorough vaccination of the inhabitants.

The State imposes certain qualifications not only upon dealers in drugs, but upon physicians, before they can practice in the great art of prescribing suitable remedies for disease. A more important State duty is the enactment of wholesome laws to prevent disease. This is done without infringing upon the personal or political rights of any citizen.

The first duty is to remove the causes of pestilences and epidemics, foreign or domestic; and where these unfortunately prevail the second duty is, by vigorous administration of proper laws to prevent their spread, and put an end to their existence. When the pleuro-pneumonia came into the United States from Holland—once the great depot of this disease in Europe—and when, to an alarming extent, it was carried into England, the realm there, and the State and Federal governments here did not hesitate to act forcibly and promptly for its removal. Holland, profiting by experience and energy, reduced by inoculation, the disease to one or two per cent., and finally stamped it out. If Massachusetts and other States have accomplished a great work in preventing the lung plague in cattle, what ought not all the States to do in preventing even a worse disease in men, women and children?

A decent care for the people by the State and a decent respect for the government by the people establishes reciprocal relations that no party can neglect. The lives, health and happiness of all classes of citizens depend upon these mutual observances of duty; hence the existence of the State Boards of Health, created by law to discuss and enforce obedience to the laws passed. The law, in all its provisions, is for the common good. It is a simple application of the science of

medicine in the form of remedies or preventions to the people of the State. It teaches mankind not only the inestimable blessing of light and air and water, of ventilation and drainage in dwellings and places of business, but the absolute need of the best use of these great gifts in nature, chemistry and discovery.

HEALTH LAWS AND THEIR WORK.

It is demonstrated in the city from which I come that thousands of young lives have been saved yearly for twelve years and more by the enforcement of health laws passed by the State. Recent New York laws relating to the tenement-houses impart great comfort to their poor occupants and add largely to the number of lives saved.

The death-rate of the city now numbers between 27,000 and 30,000 each year, and one-third of this number of lives could be saved if the best health laws could be enforced. Eminent physicians, verbally and in their written reports, assure me that one-third or more of the prevailing sickness in town and country could be prevented by the observance of sanitary laws. Mr. Edwin Chadwick stated years ago to the British Scientific Association that both sickness and death-rates had been reduced one-third by the practice of sanitary laws, and that the death-rate in the old districts has come down to sixteen or seventeen in each thousand persons. With no over-crowding and with a proper supply of water and surface cleansing, the death-rate can be reduced to ten in the thousand, which is one-half less than the mean death-rate among the general people.

More remarkable than even this promise, but resting about upon the common sense rules of fidelity in public service—and adding, perhaps, a becoming sympathetic interest in the happiness of mankind—is the statement that in well-governed institutions for children between the ages of three and fifteen years; the death-rate can be reduced to two-thirds of the number generally prevalent, or to three or more in each 1000 children, and with a corresponding immunity from all common epidemics.

Even in the British reformatory prisons, by the careful use of preventive medicine, the death-rate has been reduced to three in the thousand, with a general exemption from diarrhœa, dysentery, typhus fever and eruptive diseases. The diseases belonging to the respiratory organs are also reduced to one-half.

The cholera epidemic, which prevailed in England in 1832, frightened the people there into the necessity of securing more of the decencies of life than had before been enjoyed. The panic of a scourge, like most other panics, prompted many of the people to put on their thinking caps, and from the consequences of the cholera came, in the course of ten, twelve and fifteen years, valuable government reports and laws.

These laws, if Dr. Bowditch be correct, are in advance of the laws

of all other countries; and one man, Dr. Farr, was the bright particular star in this work of sanitary reform, not only for Great Britain, but in many other parts of the world. If disease spreads by contagion, so also good example and benevolence inspires imitation. The great pioneers of the world in discovery and work have proved the greatest benefactors, and to the good beginnings at home and abroad we owe to-day the existence of twenty-eight State Boards of Health in thirty-eight States of the Union, and all of these have been established within sixteen years. Lord Derby along ago declaed that "no sanitary improvement worth the name will be effective, whatever acts you pass or whatever powers you confer on public officers, unless you can create an intelligent interest in the matter among the people at large." Lord Beaconsfield spoke the truth for his own country when he said, as prime minister of England, six years since, that "the health of the people is the first duty of the statesman." This sentiment is at least equally true in a country of such enormous proportions as our own, and daily increasing, not only from its own inherent growth, but as the destined home of millions now in the world.

The government and the States are not asked for what so often excites and thrills the body politic by the possession of the place, patronage and power, but simply to engage in the paternal work of saving lives and promoting the health of the people. The appeal is to the common sense and practical humanity of members of Congress and of the Legislatures of the States. The motives for this needed work are of our best natures, "since the greatest good of the greatest number of people," is all that is asked.

If, when governed by such considerations, the people refuse to act, the law here as abroad must take it course, and penalties be imposed for its violation.

Nor is it enough, as expressed a hundred years ago and more by Edmund Burke, that "men *mean* well. It becomes them to do well." You are asking nothing new of the State or Government. Centuries ago the republics of Greece and Rome had their sanitary laws, and the argument then as to-day, as a part of the important work of the period, was that physical culture would secure physical health. The old Romans had their systems of ventilation, drainage and sewerage, their splendid aqueducts, baths and pavements, and all of them promoted the comfort, and convenience of the people. Sanitary law also was a part of the Mosaic law, and in practice better at times than the customs in our own American towns and cities in the closing years of the nineteenth century of the Christian era.

Among the lost arts and blessings of mankind unfortunately were the lost codes of the law relating among other things to the public health. The code of Justinian and the laws of Lycurgus, with the laws for justice and health went into decay, and for a thousand years and

and more books and learning, and in a certain sense, deeds of practical charity were confined to the monks.

It was a long forgotten lesson among general teaching that "cleanliness was next to godliness," and therefore a very close neighbor to all kinds of practical piety. Hence, clear up to and far into this nineteenth century, came agues, malaria, small-pox, cholera, scurvy plagues, and pestilences, and all the inherited ills of life to which, from negligence and ignorance, flesh and blood are exposed. Happily for the world, public opinion is now more aroused than ever before in the interest of the public health, and the subject reaches us in the threefold of economy, thrift and morals.

If, as alleged by way of criticism, the health service is costly, it can be proved to be the best possible investment to meet the cost. We began in the New York State Board with an appropriation of $15,000, and it may be more or less hereafter. The City Board of New York asks for the year 1887 the sum of about $275.000 and now for general work $20,000 and has money well invested in buildings and institutions. In saving health and lives it will save more for the city, in income and taxes, than any general investment of skillful financiers. If to this result the money value of life is counted, the five or six thousand lives yearly saved will run into millions of dollars. In Great Britain they place this kind of a value on human existence, just as we say in the United States that the cash value of every able-bodied immigrant from the Old World is $1,000. There Dr. Farr—perhaps the highest authority in the Old World—placed in his report as the registrar-general of the government, the money value of each man, woman and child in the United Kingdom as $795. The neglected preventable deaths in England and Wales during the school period, apart from infant mortality, makes a loss to the State of $95,000,000. The estimated value of lives lost in the cases of preventable deaths was estimated at $200,000,000 in a population of fifty millions of people in the United States alone and the people now number nearly 60,000,000. The British life insurance companies and friendly societies also give the money value of work lost by sickness. For every death there were, as proved on a careful investigation by the government, two persons sick and disabled, thus making a loss for each death of 730 days in each year. This result is reached by placing the minimum of the entire population at the sum of $795 here named, and to these figures are added 50,000 lives annually in the school age in England and Wales alone, which might be saved. But such statistics are exhaustless, and I must leave them for more practical conclusions.

In considering the subject of State law and personal work it will be wise to recognize the principle in regard to disease—especially is this true in cases of quarantine—that it is not places, but *principles* which secure public health. This rule applies alike to the ship, the shop and the home. Ship fever, under proper treatment and practice, has be-

come what Dr. Vanderpoel called almost a mythical disease, and by simple cleanliness is now easily mastered.

Cholera latterly has been the one disease most dreaded because it is very insidious in its visitations. It comes to us specifically in old clothes, worn or concealed, in tangible filth, capable of removal by proper disinfectants or in unventilated trunks, garrets, bundles of imported rags, sinks, cellars, yards, cesspools, and in like combinations and accumulations. Whatever may be said of germs or poisons in the human body, the conviction is that outside the human body there are, as a rule, positive preventives of cholera, in thorough cleanliness and care. Panic is a public enemy, and almost a personal crime in the effect it has upon timid minds and on persons afflicted by infirmity or disease.

This and all States may, by proper warning and timely action and enforced temperate living be ready to meet this common enemy when it appears, and preparation for possibilities is alike a public and a private duty. It is possible for science to detect causes and remedies for cholera, and by the aid and blessing of Providence it is also possible for human skill to diminish, if not destroy, this dreaded disease. The filthiness of Paris, is a warning to the people of the United States, and there are places in my own city, probably in your own State, where the waters are a source of pollution, and where the streets, alley-ways, yards and houses abound in filth.

Every citizen in his own State, his own home and place of business, may be a practical sanitarian. In the four cholera visitations at New Orleans, between 1832 and 1855, the deaths numbered 51,300. This warning after a long time proved the necessity of sanitary organizations to meet and fight the disease if it came again. Whatever the causes of this evil, duties are made so plain that they must be enforced.

What the cholera has cost Europe in life and health is beyond human calculation. The known fatal cases in Italy alone during the visitation of 1884 to first of November, 1884, numbered 14,928. In Naples there were 6,629 deaths; in the province of Naples 14,137 cases and 7,576 deaths. In money the cost, chiefly from terror, is placed for the continent of Europe for ten months at nearly $25,000,000. Its introduction into Paris last year increased the alarm, the mortality and the suspension of business. It returned to Paris in November, not without warning, but the warning was unheeded until the disease appeared in Paris. In Spain the disease was more wide spread than than in Italy. As a present warning to the United States it may be stated that there was no timely inspection of unhealthy dwellings or hospitals though cases of cholera were found in Paris in June and July.

To show the necessity of calmness and promptness in the kind of work to be done it is proper to state that during the summer, and first

autumn month in Italy, the number of cases reported was 19,762, and the number of deaths from cholera 9,824. In France and elsewhere the epidemic in Paris proved to be the real Asiatic cholera.

Cholera, though not mastered by being stamped out in the same way, is often under control, and its spread into towns and States along the coasts and rivers can be prevented. It comes at first from importation. Importation, if need be, can be forbidden, and by law and care its spread, if it should come, can be prevented. When in 1832, 1848–49, 1854, 1865–66, it entered the United States and Canada, it moved as fast as travelers could be borne by steam to the far West and left its footsteps of sorrow all along the road from New York and Quebec. So also in 1848 it entered New Orleans from Havre, and forced its way along the Mississippi reaching towns and cities 1,000 miles apart, and surviving the winter, it pursued its ravages over land and water in 1849–50. Had the United States, or Louisiana alone, possessed power now given under existing laws, no such disaster could have occurred.

Sanitary laws properly executed, I need not say have prevented and can prevent, the spread of cholera. The law, must be supreme, and not only supreme but cover districts, precincts, towns, counties, States and governments even to the interposition of international authority. There must be the *cordon sanitaire*, as along the vast frontiers of Russia, and maritime law in the hands of faithful officials, and these officials must be sanitary officers, as we have seen them upon the Red sea, the Mediterranean, at Medina and Mecca, keeping back and pushing forward the hundreds of thousands of Musselmen pioneers and herders, who, but for the law and its vigilant observance, would bear disease and death wherever their footprints are found.*

What John Stuart Mills calls "the limits of the province of government" we must agree, whether spoken of the State or of the citizen, excludes no good work. It may and should exclude all needless forms of non-intercourse common to the middle ages and in later periods of time, and all oppressive methods of administration, as when petty despots govern the people; but whatever is needed for absolute good of the people in establishing and maintaining the public health must be performed. If the law is bad repeal it because it is bad, or amend it until it is wise and timely. In New York we have a compulsory law requiring vaccination, but it is almost a dead letter except in single cities, and vaccination is generally reduced to deeds of charity

* In England and Wales the death rate has been steadily reduced for ten years and much more in the last five years than in the first. The registrar-general points out more than 281,000 persons surviving the last five years whose deaths would have been recorded had the mean rate of mortality been equal to the ten years, 1871–80. The effect of longevity has been indicated by Mr. Noel Humphrey, who states that the reduction in the death rate from 22.5 in 1838–54, to 20.8 in 1876–80 added two years to the life of every male born, and three years and a half to that of every female.

or to simple individual volition, even when the public welfare requires obedience to the statute. It is the cost to the State that some people complain of, but as a question of State economy I hope I have removed this objection. The real State cost in all the United States at present is less than $5,000 for each million of inhabitants, and the saving covers the cost ten times over. The civil war is reported to have destroyed 1,000,000 persons. Sickness wastes more than war—20,000 a year in London and 120,000 in the United Kingdom, and if recorded figures from medical men are true, the equivalent of 700,000 years of individual human life are lost by neglect among the 500,000 of people in the State of New York and 75,000 years of human life are also wasted every year there by sickness, and New York is not worse off than other States of the Union. The life average falls short ten years each of what it should be. So in England also we read the important truth that in healthy districts of the kingdom persons who reach the age of twenty years pass on to the fair age of three-score and three years and nearly a half; while in the general districts death comes within forty-five years. The annual money loss of this single death record, coming from ignorance, neglect and crime, is stated at nearly $50,000,000, besides the loss from impairment of health and from poverty among those not positively dead, for to each death there is an average of twenty persons who are sick.

When it is known that in small-pox, isolation and vaccination provide the cure for a loathsome disease, the existence of which is concealed where it notoriously is, the law or its officers are at fault. When it is also known that bad air produces bodily and mental disease, and that proper ventilation, heating and water supply are remedial measures, it is the duty of the law, put in practice, to point out and remove the evil. The law, in some of our cities at least, prescribes where houses shall be built of brick or stone only, and if it is a wise law, may not the construction and drainage, sewage of lands and workshops also be regulated by law? Mr. Edwin Chadwick says that by following out a correct principle three houses may be well drained at the present cost of one. Mr. Edward Atkinson, also good authority, declares that unsafe buildings cost more to construct than fire-proof buildings. It is proposed in England to guarantee dwellings as safe to live in on the score of health, and simply by evidences of proper construction and drainage. When sewer air poisons the blood and produces diphtheria, dysentery, and malaria in other forms, who shall condemn any proper law to prevent poison and self-inflicted murder? So in regard to adulterations of food. Take, for example, the simple article of candy, much of which is reported to be made from grape-sugar, glucose, and "terra alba," the latter being sold at one cent a pound, and the former at four cents a pound, where granulated sugar costs by the barrel ten cents. The cheaper candies may

be impaired by impurities, or depreciated in value, from fifty to seventy per cent. It is a public duty to resist all impurities, both in the food we eat and the water we drink, and in the contaminated air we breathe, in all dwellings and all workshops and in all that is around them; and let me say in speaking, alike for State and citizen. that "obsta principiis" is the only safe rule of action. When the people of Great Britain discovered that more than one hundred articles were adulterated, the British Parliament as long ago as 1815 passed the best law extant, and since known as "the Sale of Food and Drugs Act."

This subject addresses itself to the hearts, minds, and bodies, and estates of every man and woman in the land. The real wealth of a nation is counted not in the mines of gold and silver, nor in the more useful metals of iron, lead, copper and tin, nor yet in the millions of acres of land cultivated by between five and six millions of our people; nor in the work produced by half this number of persons employed in the manufactories and workshops of the people; nor yet alone in the treasures brought up from the depths of the sea, or borne upon the two oceans which surround us; nor from or upon our grand lakes and large or limited rivers. These are grand and stupendous sources of material wealth and physical greatness. But, as far above them all as the heavens are from the earth, as a simple question of value, is the general health of the people. Here alone is true manhood, real civilization, the source of contented life, peace and rest in the family, pervading happiness and substantial good-will among men. Here alone the personal man is the true temple of the undying soul, and only the purified abodes of men are fitting habitations for this vital principle.

We sum up, then, the duties of the Federal Government and of the State, in the following order:

1. Supervision over the health of the people; peaceably if it can be done, forcibly if necessary. Where the Federal Government has authority, as upon the sea, lakes, rivers, over forts and arsenals, over army and navy, in legislation for commerce, international, inter-State and internal, especially in regard to infected vessels, over animals exported and imported, this authority belongs to Congress. It has been proved, I think, after the most laborious investigations for nearly two centuries past in this country, that the epidemics appearing among us have been traced to importations. If epidemics in this and other cities seem to disprove this fact, the seeming exception is due to the bad sanitary condition of the localities named, or to the fact, as stated by Dr. Vanderpool, to the germs of disease concealed and dormant in some cellar or room not reached by the purifying air of heaven in the place where the disease exists. The port of New York for four months of the year, is as much exposed as New Orleans to yellow fever, and it is kept from New York, not by non-intercourse but simply

by the practice of correct principles of quarantine by vigilant and capable officers.

There has been no national interference in New York as in Louisiana, because the State system in New York was and is so complete that the Federal Government acknowledges that with us the State system is about as perfect as it possibly can be. I hope it is as efficient in the port of Philadelphia.

2. State governments are clothed with power over the health of the people within their commonwealth, and over the territory where the Federal Government is without this kind of jurisdiction. The colleges and schools of the State, its institutions of charity and learning, its prisons and reformatories, its codes and laws, all that belongs to roads, avenues, parks, canals, docks, piers and even the public and private dwellings, when legislation is needed for health, belongs to the parental care of the State. Epidemics are to be treated like public enemies, and often they are worse than armed foes because more insidious and often beyond observation. They come in foul sewage, polluted streams and wells of water corrupted by cesspools and closets. They come like a thief in the night and steal away those jewels of the household, the little ones, whose lives are more precious to their owners than all the wealth of the State. To prevent adulterations in food and drugs—not practiced, I hope and believe, to the extent reported or suspected—is another State duty.

To clothe boards of supervisors and trustees in towns and villages, mayers, common councils and health boards in cities, not only with ample power in regard to health, but to require them to pass and enforce ordinances, is a positive duty of the State. A State bureau of health is essential to secure these results, and its action must be impartial, effective, vigorous, determined, and take no step backward.

3. While Federal and State governments are bound to do what is here suggested, a higher law of duty rests upon the woman of the household and upon faithful men of business. When a woman suggested the first board of health in the State of Massachusetts, the appeal only came when typhoid fever was discovered in a seminary of learning at Pittsfield. The State cannot secure obedience to law without the sympathy and coöperation of the people. Light and air, cleanliness and order, are the great preservers of health, and the wives, mothers and daughters, as the necessary mistresses of our dwellings, can best serve the State when they secure the greatest possible health in their own homes. Dr. Farr prescribes the right remedy when he says that "health at home is health everywhere," and when he adds, as his conclusion from experience, that "the whole future sanitary movement rests for permanent and executive support on the women of the country." If it be true that "the predisposing causes of insanity of the United States can be traced to malign influence on childhood," no wonder we had from Dr. Wilbur, of New York, before his

lamented death after a most useful life, the startling record that there were 50,000 lunatics in the country, or that we are behind England, Germany and the age in which we live in our treatment of this class of unfortunate people.

4. A word as to quarantine. Commerce cannot be forbidden; but it may be regulated when hurtful to health. At best, however, State law is only a relative guarantee of the public safety, and sanitary instruction, if heeded, is more important than sanitary legislation. Quarantine and commerce are natural enemies, and the State must regulate the relation between the two—the State always insisting that as far as possible the public health, within its borders, shall be permanent. Every nation and every State has the right to use intelligent ways and means to preserve health in and over all its borders, and the Federal Government also has rights which must be respected, and laws which must be obeyed. There are natural, legal, wise and conservative lines between nations, States, municipalities and towns. Where the death-rate in England is 19.9 in the 1,000, in Austria, 31.3, and close on the latter number in all parts of Italy, and where, as in the United States, four lives in each thousand of people are absolutely wasted, official action is demanded in the name of public safety.

Your city of Philadelphia, next to London, where the mortality has averaged nineteen and a fraction, (here twenty in 1,000 each year,) is one of the fortunate large cities of the world for causes I presume, amply discussed in your report. You have not, as in New York, 23,000 tenement houses and more; your population is not of alien birth and habits of life.

I have spoken of the unities of the State with brief space left to name the duties of the citizens to the commonwealth.

Among our first duties is to aid, protect, support and uphold the State in the performance of all obligations to persons, communities, institutions, organizations and legal authorities. To this secular obligation of common duty may be added so much of that higher law which, quoting the words of Tillotson, declares that "religion obliges men to practice those virtues which conduce to the preservation of our health.

"Daily duties, paid hardly at first, at length will bring repose to the sad mind that studies to perform them."

With this text, permit me to give the reason for the faith that is in me, trusting that we all may be able to practice the sentiment of one of the poets, that in real life

"The primal duties shine aloft like stars."

If then the State owes order, law and protection to the citizen the citizen owes to the State, in return, allegiance and self-preservation to himself and to those dependent upon him. The State provides

schools for the young, hospitals for the sick, asylums for the deaf and dumb, for the blind, the idiotic, the insane; and poorhouses, reformatories, jails and prisons for the unfortunate and vicious class of people. The greater or lesser number in the several institutions and places depend upon the causes and conditions of those sent, or sentenced to occupy them. The State performs its duties when it provides needed comfort for the absolute poor, and needed punishment for absolute criminals. All beyond this for securing public or private good belongs to personal and responsible administration; and this is true whether the subject relates to institutions or families. Citizens make the family; families make the State; and States and Territories compose the general government. The safe beginning will, as a rule, always make the safe end. In the State we are not only to enjoy life but to live nobly.

Aristotle most truly said that it is only by labor that thought can be made healthy, and only by thought that labor can be made happy, and the two cannot be separated with immunity; where both are best preserved the State life and the life of the citizen will be most secure. Whoever stimulates research into questions relating to the health of the people, secures as the first fruit of that research a knowledge which benefits mankind. This knowledge born of observation produces the experience which comes from observation. One of the first lessons thus learned is that governments best represent the people, and only represent them when those in power maintain what is wise and good, and provide punishment for what is dangerous and vicious.

The State in this sense is a civil power, a political power, a governing power of the many by the few,—the many consenting to this form of government, which means the body politic, united and organized to establish and maintain the rights, interest and welfare of the people. In a limited sense such a government is a district, a town, a county; and these grow into a commonwealth. In a larger sense, it is a league, a confederation, and that form of federal power which most of us now call and respect as a nation. This is the imperial power of the body politic, united for all the purposes set forth in our constitutional form of government, and from which, short of revolution, there can be no dismemberment.

The first duty is the safety of the republic, and the second, like unto it, is the promotion of the six great precepts set forth in the preamble to the Constitution, and this is true of the public health which is necessary to all domestic tranquility, to all that belongs to the general welfare, and I may add, to justice, in the proper presentation of what is due to the people from the State.

I present this branch of what relates to popular government and duty as of the highest importance to the country and to mankind. Therefore, let the public school room, academy, college and university impart what is due to the State in return for what the State has done

for them and is always doing for its children. These duties defined mean sanitary inspections of schools, by competent local boards of health and of all public institutions. Among the discoveries to be made are the causes and effect of those terrible diseases diphtheria and scarlet fever, and of all the emanations from malaria and blood poison. Inspectors, teachers and parents to arrest diseases like these owe service to the State. To ensure non-communication, isolation, safety from exposure to draughts and colds, strict avoidance of impure water, disinfection when required of clothing, rooms, workshops, dwellings, and of all exposed places; the special personal cleanliness of all who suffer, and of all in attendance as nurses or otherwise. Where fire or heat are not applied to get rid of what is offensive, fumes of sulphur, copperas and other effective disinfectants must be used, and when death comes let there be no public or family funeral. "The dead," if need be, "must bury their dead." To save the lives of the living by such means shows neither want of sympathy for the dead nor for the living, but just the contrary.

SUBJECTS TO BE LEARNED WITHOUT DIRECTION FROM THE STATE.

I have seen nearly 90 per cent. of children, under two years of age, die in New York city public institutions, and I have seen the lives of children of the same age and the same dependence and condition, where less than ten per cent. of the whole number have died in the country nursery and hospital, and not over twenty per cent in the city nursery. In both town and country the good and bad results came from good or bad administration, and the good as a rule has been, and always will be, chiefly directed by voluntary service. Half as many persons die from being over-fed as under-fed, and the waste of life and the want of health in cases like these—which may be counted by thousands—is born of ignorance and indifference, for which the State is rarely responsible.

The brain, next to the stomach, is to be properly cared for to free children from diseases, known as fear, fright, hysteria, St. Vitus' dance, and kindred diseases, caused or suggested by unwisely directed advisors or educators. Let not wisdom linger when knowledge comes, always remembering, for young and old, that where there is cure by preventive care there need be no cure by medicine.

What are called domestic pestilences—such as scarlet fever, diphtheria, measles, whooping cough, and even small-pox—are largely preventable diseases, and the remedy is, first of all, personal care, and, secondly, the proper use of what belongs to the atmosphere of the locality. As vaccination is the preventive of small-pox, the reasonable logic is that every man, woman and child should be vaccinated. Diphtheria, with all its mysteries, is shown to be the result of local conditions, whether propagated by a microscopic plant or fungi, from which no one is exempt, and which exists in the mouths or throat of

all of us, but with no power of reproduction until until it receives fresh vitality from the disordered conditions of the mucous membrane attending sore throats produced by colds. It is a blood poison in the very sources of human blood, and even in the spleen and bone marrow. The poisoned plant extends to the blood, when diphtheria sets in, and the disease goes out spreading through all possible surroundings. It is declared to be possible, if existing theories hold good, to kill this human monster by artificial vaccination, and it is at least more than possible that this terrible disease may be modified, if not removed. But as it now is, even the convalescent may communicate the worst infection; and hence the necessity for domestic purification.

We read daily how and where impure water has produced (perhaps it should be said aggravated) diphtheria and scarlet fever.

In Memphis we have seen the most striking examples of wise and unwise administrations of the people. The change for the better only came after immense suffering and distress; but after it came, it inspired more than a thousand towns in the country to follow one good example. The wrong done increased the mortality to a small population, or from 29 to 30 in each thousand, to 144 colored people and 92 whites. Proper sewerage or drainage, pure water, the closing up of cesspools and vaults, restored ordinary mortality, and the cleansing of the city reduced the death-rate two-thirds. In 1879 the population was reduced to less than 5,000 whites, and in all to little less than one-half, with a corresponding reduction in the value of every kind of property. Half of the buildings with basements and cellars had no proper ventilation. Of 4,744 wells and cisterns, 3,408 were near privy wells, and in 6,000 of these apartments not 2,000 were properly built. And just here, and all through the country, may we find the worst enemies of health and of life.

The National Board of Health, by proper remedies—aided in their good work by the best people—reduced the death rate 20 per cent. in a single year. By a like sanitation the lives and health of very many of the people of Charleston, Mobile, Galveston and Jackson were saved.

The economy of a work like this means, in time, money and work, millions upon millions saved in property, to say nothing of life and health. Of the deaths in Memphis, 15 per cent. were traced to undrained soil and to deficient sub-ventilation in the homes of the people, while 57 per cent. of the total evil came from external causes, and most of all these were preventable by care.

Preventable Diseases.

The death rate rate in India, by the use of sanitary means to prevent the scourge of cholera alone, was once reduced from 22.41 to 3.29, and later to 1.26. Proper sanitation has reduced the death-rate 6

per cent. in Liverpool, 3 per cent. in Manchester, and in London from 1,100 in one million, to 400. Sanitation in London has also been reduced in the death-rate from 43.5 in 1685, to less than half this rate in 1880.

FACTS FOR PERSONAL KNOWLEDGE AND REMEDIES.

1. Carefully studied records show that typhoid fever is due to a specific poison, often producing disease, conveyed into the human body through the agencies of bad food and polluted air, and, in many places, by bad well water, coming from cesspools and like exposures. Sewer digging is another serious source of evil.

2. Scarlet fever and scarlatina may be diminished, if not stamped out, by proper exclusions, and restrictions in schools, families, and among large bodies of people collected together. Not alone the personal presence, but even clothing not used for a year, has produced this disease.

3. Diphtheria once started increases in proportion to the neglect of sanitary conditions. Decayed vegetables, fruits, and perishable fruits and products, if neglected, mean disease; and especially is this apparent where the soil is moist, as near swamps, marshes, and immovable bodies of water. Eighty per cent. of the worst cases were found at Lynn, Massachusetts, during the worst year of the disease in that locality. Even the kissing, or the breath of a friend, may communicate diphtheria. The soil needs watching whenever this and kindred diseases are found. Malaria is always most prevalent near the surface. On the marshy district of an infected town on Lake Michigan filth has been traced through the ground over one hundred feet. Where it is the least visible, it is often the most penetrable. All malarial and miasmatic fevers revel in extreme moisture.

Children are the first victims, and children can communicate diphtheria to strong mothers and stout fathers. Sometimes this disease comes from natural conditions, but more frequently from positive filth. Surfaces of mud are a part of this filth, and the sun and air may stimulate it. Though this disease is comparatively new in name, it was christened at Tours, in France, in 1818, and is even described by Hippocrates. The new facts seem to be its propagation in the form of microscopic plant.

4. Water used for drinking needs watching, and an analysis, where there is doubt or ignorance of its source or supply, is required. The transmission from wells, brooks, and springs to dwellings also need watching. Even ice, with the pure surface, may be contaminated where the water is not pure. Polluted waters are rarely detected by touch, taste or smell, and only chemical and microscopic examinations can trace the real sources of soil. Surface wells are dangerous

and sub-soil wells are undesirable. Rain water is the best of all for purity. Boil it for thirty minutes and the worst enemy is gone.

5. Sewerage is another public enemy. Sulphuretted hydrogen and ammonium sulphide are found in our sewers, creating organic fetid vapors; and these, if not wholly decomposed, make them fatally foul. Even one part of these gases to two hundred and fifty in the common atmosphere, it is said, will kill a horse, and double the quantity a dog, and only six parts small birds.

The schoolmaster who teaches pages of grammar, books of arithmetic, and the higher mathematics, chapters of logic and volumes of history and literature, should be requested to teach more of chemistry and physiology, of anatomy and hygiene, and even the principals of life insurance may be taught wisely and timely. The common schools and academies teach practically little or nothing of these subjects, and our colleges and universities but very little.

One other source of health, depending more upon the people than the State, may be traced to tenant homes, homes such as have been partially begun in New York (and where 2,478 deaths took place as certified to by the coroner without medical attendance), in Brooklyn, and more extensively in England, as described by Sir Sydney Waterloo, M. P., when visiting New York, and a philanthropist who has given many years to tenement-house reform. In 1854 he sought to secure, in the humbler homes of the people, immunity from disease, by inspection and safety from fire, and the effect of this little more than individual effort was to reduce the average death rate from forty to eighteen in each thousand persons, and the rate of insurance, on properly built tenant dwellings, to seven cents on each $100, with a small rental for each comfortable room during the time of occupation. —*Peabody.*

The homes of the people are the real sources of happiness, and what is best for health should be established and recognized there, and in properly constructed and regulated workshops, school-rooms and churches. In the latter physiology and physic may at times enter into that divine philosophy which teaches the ways of God to man, and in the very front rank of this intelligence should be the duty and wisdom of creating, establishing and maintaining the health of the people.

The work of Florence Nightingale in England and the Crimea, in peace and in war, in the hospital and in the camp, shows what one woman can do to save life and relieve suffering. In a like spirit, in a different field of labor, but inspired by the same divine thought, Octavia Hill, in London, possessed for long periods of time various pieces of tenement property, each one wretched in itself, and worse in the character of its inmates, and, as a lessee, visitor and friend, cleaned and repaired, made habitable and comfortable, all these hitherto miserable dwellings. In the same spirit a committee of benevolent

ladies, to the great saving of health and life, have in charge as many as possible of the more than twenty-three thousand tenement houses in the city of New York.

I read of the lives of 10,000 children saved in a short time in England, simply by the proper care in the use of the gifts of God to man. These agencies have been the medicines of nature, air, water, and care, prescribed by a little practical wisdom. I read also in thirteen towns of England of a decrease of more than 17 per cent. in the death rates from proper sewerage alone; but there, as here, there remains immense room for improvement. In a country like Belgium, the average lives of the cleanly and thrifty are fifty years, and of the filthy and negligent, the average length of life is only thirty-two years, and Belgium in this respect is not a peculiar country.

I leave it to experts and to the doctors to be specific as to the origin, character, extent and definition of diseases. As a layman I see and comprehend the effect they have upon organized communities, people, and individuals. I know what foul air, impure water and bad food mean, and I would, if I could, remove them from all conditions of household and animal life. Yes, and I would, if I could, remove them from the face of the earth. I try to distinguish between abnormal decay, common to human existence, and the decay which comes from disease. Science and art long ago banished from the world the wholesale pestilential loss of life in what was called the disease of "Black Death," and "Sweating Sickness." They killed more than great wars. —*Canaro.*

The study of chemical combinations, of biological conditions and of epidemical relations, as a layman, I may not understand; but every one can comprehend what an epidemic is, and if he can trace it to foul water, to exposed cesspools and other tangible offenses, the way is pointed out to remove the cause and to remove the evil. The sick animal and the sick plant, and whatever causes or enters into the decay of man must be cured, or the natural consequences follow.

As the proverb says, "An ounce of prevention is better than a pound of cure." Even the brute creation, as in the marshes near Rome, have, through experiments, shown symptoms of malaria produced by infection of the soil and air.

Dr. Billings states that 100,000 lives are lost each year from sheer neglect, and 200,000 cases of prolonged sickness are added during the same year. In reality the dead and the sick, who might be saved, are far beyond these figures. The greatest loss is during the age of childhood; but neglect, ignorance and vice spare neither age, condition nor sex in any of the years of our lives. Death-rates are among the important studies in sanitary science; because, first, they give a very sensitive test of sanitary conditions; and, secondly, the places where they are most apt to die are necessarily the places where survivors are most sickly, and where, if they survive, they beget a sicklier brood

than themselves, even less capable of labor and less susceptible of education. A high local mortality of youth must always necessarily denote a high local prevalence of the causes which determine a degeneration of race. Dr. West says the frail child never passes completely into womanhood, but fades and droops in the transition stage through which she has not the strength to pass; and this is the sad record of advancing years. We know from experience, how in the State, pauperism may be perpetuated in the double form of immorality and disease.

The birth-rate, it may be interesting to state, is largely in excess of the death-rate, or 36 in 1,000; and the annual increase of births over deaths numbers 878,572.

In contrast to the sad records (many before me) let me say that, upon the whole, the health service of the country, and of the world, is certainly improving; but while this is true, it is necessary to add that, as an entire people we are only in the beginning of the required work of real civilization. The death-rate in the United States army from all causes is but nine per thousand of white men and twenty per thousand of colored troops.

In my State I record with satisfaction that since the establishment of the State Board of Health, local boards have been organized in twenty-four cities, nearly three hundred villages and in all of the nine hundred towns of the State. The cause of this improvement is due to the fact that physicians in many of the counties of the State, supported by boards of supervisors, village trustees, county, town and district clerks, and, indeed, by nearly all county officers, have been requested to coöperate with the State Board of Health in maintaining public health at home, and to this end they were asked to respond to any and every call looking to private and to public works for the consideration and discussion of measures relating to drainage, sewerage and general cleanliness; to the ventilation of schools and public institutions; to supplies of pure water; to the proximity of wells to cesspools; to the adulteration of food and drugs, as affecting health, and to all general work which seeks to secure the health of the people. Work at home, as the best missionary field of labor, is the first improvement needed. The best work always begins there.

When, many years ago, Lord Palmerston met his Scotch petitioners, asking for a day of fasting and prayer, he gave them the wise but rather startling answer: "Go home, and see that your towns and cities are freed from those causes and sources of contagion which, if allowed to remain, will breed pestilence and be fruithful in death, in spite of all prayers of a united but inactive people!" And Ruskin, at a later day, declared that "any interference which tends to reform and protect the health of the masses is viewed by them as unwarranted interference with their vested right to inevitable disease and death." And this amiable cynic induced Octavia Hill to invest ten thousand pounds

sterling of her money in the lowest quarter of the city, where she might witness the transforming power of its worth in sanitary reform. And so this noble woman, aided by Ruskin's money, proved that wealth is health, and that health means the happiness of the people.

In this spirit, Ralph Waldo Emerson, many years ago, in his words on "One in Robust Health," said, in a spirit which I have endeavored to inculcate: "The first wealth is health. Sickness is poor spirited; it must husband its resources to live. But health answers its own ends, and has to spare; runs over and inundates the creeks and neighborhoods of other men's necessity."

Let me prescribe one other rule of business, and for domestic and public duty; banish from your dwellings all possibilities of contamination from effete matter, all noxious and miasmatic gases from fecal decompositions resulting from soil and sewer pipes. Obstructed pipes send back into your closets, sinks and basins the foulest odors, and only the freest flow of water can keep them clear and clean.

If the sources are all pure and the road straight and clear, there is a way of escape. The head of every house and building should be practically a health inspector. Open the doors and windows of your dormitories and school rooms that the sun and air of heaven may enter therein. A little care will shut out filth and darkness and make room for the light and the vigor of health.

One marked feature of our American life is the disease known as fret and worry. The haste and zeal of the times causes what is called "American nervousness," which means mental and physical derangement, and which, in turn, again means what has been characterized as hypotism, hysteria, catalepsy, somnambulism and other preternatural and abnormal manifestations and hallucinations, as seen, in part, in Guiteau's villainous purpose, whatever the measure of his alleged insanity, for killing President Garfield. Some of these evils are born of deceit, passion, vanity and imposture. Others are born of intemperate lives and habits and education, and produce insomnia, dyspepsia, irritability and a long train of nervous diseases, or disorders, characteristic of the times and the people. These are the diseases which lead the way to asylums for the idiotic and the insane, where it is so hard to—

> "Minister to the mind diseased,
> Pluck from the memory a rooted sorrow;
> 'Rase out the written troubles of the brain;
> And, with some sweet, oblivious antidote,
> Cleanse the stuff'd bosom of that perilous stuff
> Which weighs upon the heart."

The only offset to this amount of fret and worry is a corresponding reduction of inflammatory diseases; and this secured is almost, if not quite in proportion to the growth of nervous irritability, with a corresponding increase of longevity when disease is most apparent.

But leaving all these specific references to life and death, disease and cure, let me close with a single reference as to the duty of the

citizen and the State, condensing both in one: "Duty is a moral obligation imposed from within; obligation is a duty imposed from without. Duty implies a previous obligation; and an obligation involves a duty. * * * My obligation is to give another man his right; my duty is to do what is right. Hence duty is a wider term than obligation. Duty and right are relative terms. If it be the duty of one party to do something, it is the right of some other party to expect or exact the doing of it."

XX. Remarks on Vaccination.

By W. M. Welch, M. D.,

Physician to the Municipal (Small-pox) Hospital of Philadelphia.

I risk nothing of truth by asserting that of the innumerable advances in sanitary medicine, from the time of Hippocrates to the present, the discovery of vaccination is the most important of all. No other single discovery has been the means of mitigating so much suffering and of saving so many lives as that of Jenner; and his name, therefore, deserves to be placed at the very head of the long list of benefactors of the human race—a class of men which the world too often forgets to honor.

Jenner's attention was first called to the subject of vaccination by hearing a country woman remark that she could not take small-pox because she had had cow-pox. Upon investigating the subject he found that milkers of cows not unfrequently became infected by an eruptive disease which appeared on the udder of the cow (a disease evidently more common then than now), and that to such persons it was impossible to communicate small-pox by inoculation. He thus began to study scientifically this traditional belief of the country people of his neighborhood as early as 1776, but on account of the opposition and ridicule with which his theory was treated, even by the most eminent men in the profession, he did not venture to do his first vaccination on man until 1796. He then clearly demonstrated the fact that cow-pox once communicated to the human being may be transmitted from that person to another, and so in endless succession. In 1798, Jenner published his first important paper on vaccination; this paper, though I regret to say not often read, stands to-day a highly interesting and instructive treatise on that subject. In the year 1800, the "new inoculation" (as vaccination was then called), was introduced into France, Germany and the United States. It may be interesting to a part of this audience to know that vaccination was first successfully performed in Philadelphia, November 9th, 1801, by Dr. John Redman Coxe.

In the short space of time at my disposal I cannot stop to consider

the various methods of performing vaccination, or even to describe the course of true vaccinia, important as these topics are, but must hasten to discuss very imperfectly a few of what I conceive to be the more interesting and attractive questions connected with this subject.

The introduction and extensive progress of animal vaccination in this and other countries within the last few years, very naturally suggests the question, both to the profession and the public, what is the comparative value of bovine and humanized vaccine virus? I have studied this question very carefully, and have no hesitation in saying that there is really no difference between the action of bovine virus and that of recent humanization; but between the action of either of either of these viruses and that of long humanization, there is a very marked difference. Vaccinia induced by animal or recently humanized virus requires for the fullest development and completion of its course not less than twenty-one, and frequently as long as twenty-eight days—counting from the time of insertion of the lymph until the falling off of the crust—and is sure to be followed by an indelible scar, distinct and well-defined as if stamped by a sharply-cut die. On the other hand, vaccine virus far removed from its original source induces a vaccine disease of much less intensity and of considerably shorter duration. The scar also differs in a corresponding degree, being much less distinct and often quite uncharacteristic.

In 1836, when the cow-pox of Passy was discovered, there was found to be a very great difference between the course and duration of vaccinia, resulting from the use of the new virus, and that of the old; the latter at that time represented thirty-eight years of uninterrupted human transmissions. In 1844, after eight years of humanization of the Passy stock of virus, it produced vesicles which ran their full course in three days less time than when it was first discovered. The vesicles of the Jennerian stock of virus, after thirty-nine years of uninterrupted human transmissions, were found to undergo desiccation in twelve days, instead of seventeen, which is the standard period, losing in that time five days of their maturing period. The late Dr. Martin, in one of his very valuable contributions writes that, in 1859, he obtained from Ceely a supply of long-humanized lymph which he continued to propagate for several years, and that the course of the disease induced by this virus was usually eleven days, counting from the time of insertion until the crust would fall off, or could be readily removed. He also says that for nearly ten years he propagated virus which he received from the National Vaccine Institution of Great Britain, and that this virus induced a disease, the duration of which was fourteen days, very exactly, from insertion till the fall of the crust. When a public vaccinator in this city, from 1867 to 1870, which was prior to the introduction of animal vaccination in this country, and the stock of virus in use doubtless being the same as that from the National Vaccine Institution of Great Britain, I found it necessary,

in order to collect crusts for further use, to visit the persons I vaccinated not later than the fourteenth or fifteenth day after inserting the virus; if I delayed my visits to a later day my harvest of crusts would prove very scanty. How different is all this from our experience at the present time! The virus now in general use is either bovine or not many removes from the animal, and I am sure we will all agree that, in the vaccinations of to-day, it is impossible to remove the crust, without doing violence to the arm, earlier than the end of three weeks, and frequently not until the end of the fourth.

My experience leads me to assert most positively that vaccinia of short duration is capable of destroying in a person the susceptibility to small-pox. But whether the protection it asserts is as durable as that which results from the more typical form of the disease, I have good reason to doubt. On account of the greater reliability and certainty of action and more speedy action of humanized virus somewhat remotely removed from the heifer, I very much prefer it to bovine for vaccination after exposure to the small-pox contagion. Over and over again have I been able to give absolute protection against small-pox by the use of long-humanized virus employed after there was undoubted and continuous exposure. Bovine lymph employed under such circumstances has not given me anything like the same satisfactory results; and for no other reason than its uncertainty and slowness of action.

As already intimated, it is my opinion that the prophylactic power exerted by long-humanized virus is less durable than that exerted by bovine lymph or lymph of recent humanization. This opinion is not based on any direct proof, but rather on a strong inference or logical deduction which cannot be elaborated in the brief time assigned me.

During the last several years there has been a growing belief in the popular mind that humanized virus is liable to convey into the system some constitutional taint. Whether this fear is real or imaginary, I will not stop to consider; but surely animal virus is free from any such imputation, and therefore its introduction into general use is calculated to minimize the opposition to vaccination. Another advantage possessed by animal lymph is that in time of a wide-spread epidemic of small-pox, virus sufficient to vaccinate whole communities can be furnished at short notice.

The question is often asked, are multiple vesicles more protective than single ones? Most writers, I know, answer this question in the affirmative, but my own experience leads me to say that a single, typical vesicle, running regularly through its various stages, gives as great protection as it is possible to obtain from a dozen or more. If, however, the virus to be used is of long-humanization and quite weak in its action, it would be well to make three or four insertions. The practice of making multiple insertions doubtless grew into use in consequence of the deterioration of long-humanized virus.

I will not waste time by proving to you what is so well known, namely, that vaccination exerts a prophylactic power against small-pox. I will briefly dispose of this question by saying that the occurrence of small-pox, in any form, after a recent, typical vaccination, is very rare indeed; and even in the rare instances in which varioloid does occur, the attack is so mild that death never results except, perhaps, in a very feeble person.

While vaccination almost always confers perfect protection against small-pox, that protection, particularly if it be conferred in infancy, cannot be depended upon to continue throughout the life-time of the individual. If, however, the vaccination be done later in life, say at ten, twelve or fifteen years of age, the chances of the protection being permanent are much greater. It seems probable, therefore, that the changes in the system incident to puberty have in some unknown way much to do in reëstablishing the susceptibility. I do not wish to be understood as saying that protection from vaccination in infancy is never permanent, for that cannot be truly said. Perhaps in about 25 per cent. of persons there is not the least deterioration of the protection by time; but in the other 75 per cent. various degrees of susceptibility are reëstablished in the course of a variable length of time—some taking small-pox in a very mild form, and others as severely as if vaccination had never been performed. The character of the vaccine cicatrix even cannot be depended upon as clearly determining anything in regard to susceptibility. It is true that a good cicatrix is stronger evidence of protection than a poor one; but it must be remembered that it is only evidence, not proof. I have seen hundreds of persons who were vaccinated in infancy and presenting typical cicatrices suffer from small-pox in adolescence and adult life; and the death-rate among this class of patients is far from being insignificant. The sooner, therefore, the public, and, I may say, the profession too, come to recognize the fact that vaccination in early life, however typical, cannot be depended upon to confer permanent immunity from small-pox, the sooner will communities be spared from the decimating effect of constantly recurring epidemics of this most horrible disease, because such a knowledge would lead to the more general adoption of re-vaccination.

This brings us to consider, lastly, the value of re-vaccination. Many think that because the vesicle of re-vaccination does not as a rule pursue the regular course of that of true vaccinia, the effect is merely local, exerting no prophylactic power whatever, and therefore that re-vaccination is unnecessary. But surely re-vaccination, to be successful, need not necessarily pursue the typical course of vaccine, for we know that small-pox itself after vaccination frequently differs very markedly from the course of the true disease. If then we have modified small pox, or varioloid; after vaccination, may we not also have modified vaccinia, or vaccinoid? Believing this, as I do, the conclu-

sion is inevitable that as varioloid gives protection against a recurrence of small-pox, so also does vaccination exhaust whatever susceptibility to the disease may have been acquired since the previous vaccination.

At what age should re-vaccination be performed? The answer to this question depends very much upon the thoroughness of the primary vaccination. A child well vaccinated in infancy only occasionally takes re-vaccination under ten years of age; but under circumstances of great exposure to the contagion of small-pox, it would be well to re-vaccinate children somewhat under that age. During the second decennial period of life the necessity for re-vaccination very greatly increases. A person who has been well vaccinated in infancy, and again at or above the age of fifteen years, will, as a rule, remain protected for the remainder of life. But if one wishes to feel perfectly sure about his protection, it would be well to have re-vaccination done whenever small-pox prevails.

In seeking for evidence to prove the efficacy of re-vaccination, we need only consult the statistics collected during the Franco-Prussian war. It is well known that in no country is vaccination more carefully and systematically performed than in Germany. Every infant there is vaccinated before it has completed its first year, and re-vaccination is done at or about the twelfth year. Every person entering the army is again vaccinated, and, if that fails, the operation is repeated until the surgeon is satisfied that the person is insusceptible to vaccinia. Hence the Germany army may be said to be a well vaccinated army. On the other hand, in the French army vaccination and re-vaccination were in no wise compulsory. During the war small-pox prevailed to an alarming extent, and both armies were freely exposed to the contagion. The loss by death from that disease in the German army was only 263 men, while the deaths in the French army amounted to the enormous proportion of 23,468; and the French army was never very much more than one-half the size of the former.

Physicians connected with hospitals for the treatment of small-pox bear testimony very uniformly to the fact that persons with a history of successful vaccination and re-vaccination are very rarely admitted as patients. Not only is this true in my own experience, but, furthermore, I have never seen a nurse, or any employé in the hospital in this city take small-pox, provided vaccination or re-vaccination was well performed before entering upon duty. While, on the other hand, the disease has attacked a few such attendants, in whom re-vaccination was for some reason omitted or neglected.

Did time permit I might add very largely to the evidence presented in this paper proving the prophylactic power of vaccination; but we have before us, I think, facts sufficient to warrant the conclusion that if vaccination were effectively performed in infancy, and re-vaccination universally employed at the age of puberty, the world would then

begin to realize that Jenner was no mere dreamer when he claimed for vaccination the power to extirpate small-pox from the face of the earth.

XXI. The Present and Prospective Sanitary Condition of Pittsburgh, Pa.

By CROSBY GRAY, *Health Officer of Pittsburgh.*

For convenience of description and simplification of details, we deem it advisable to divide the city into *three* divisions. Nature did this for us originally, while the site was still an unbroken wilderness, but instead of *three* divisions she made *four*. On one of these, viz: that portion lying north of the Allegheny river, is located the city of Allegheny, with a population of 95,000. It is connected with Pittsburgh by numerous bridges, and although practically forming a part of it, it has a separate municipal government and does not come within our jurisdiction. There remain then to the city the three natural divisions locally known as the "Old City," the "East End" and the "Southside," containing an area of 29.3 square miles, and a population of 200,000. In general terms the population clustered around the point where the Allegheny and Monongahela rivers unite to form the Ohio may be modestly estimated in round numbers at 300,000.

"OLD CITY."

The portion known as the Old City comprises the original twelve wards, and is located in the angle formed by the union of the Allegheny and Monongahela rivers, extending back to a line of hills, rising at its highest point 530 feet above the level of the rivers, and which formed originally a natural barrier to the extension of the city into what we now term the "East End" division.

The old city contains an area 2.1 square miles and a population of 70,000. Its topography is very irregular, there being little or no level or marshy ground.

It is admirably located for drainage. Perhaps it was on account of these natural advantages that during many years of its history no systematic plan of sewerage was devised and constructed to meet the requirements of its increasing population. A rigid economy seems to have been exercised in this direction for the reason, perhaps, that its topography necessitated the expenditure of large sums for grading its streets, heavy cutting and filling being required to a much greater extent perhaps than in any other city in the country.

The sewers have almost all been constructed within the last 25 years, having been gradually extended as the property became sufficiently valuable to pay the assessments levied for their construction.

It is the old, or "combination system," the separate system devised by Col. Waring not yet having been introduced even as an experiment. The absence of sewers during all these years necessited, of course, the construction of cesspools, and it is no exaggeration to say that the number is only limited to the number of houses.

It is true that where sewers have been constructed many of them have been abandoned, emptied and filled up; but they still exist in sufficient number to be a constant menace to the public health. The Old City contains 45.04 miles of paved and 4.47 miles of unpaved streets.

The streets are kept as clean, by means of scraping and washing, as is possible in a city where garbage is left to be disposed of by each individual or family, the result of which is, that it is thrown into cellars, cesspools, yards, alleys, and even upon the public thoroughfares. Some of it is hauled about the streets until finally what remains in the open cart or wagon, is deposited upon some vacant lot.

By reason of its excellent natural drainage, the fact that so much of its surface is paved, and that but few if any wells or springs are used or exist within its limits, the Old City, although the most densely populated, exhibits a lower death-rate from preventable diseases than the south side, or even the East End, if we exclude the sparsely populated country districts.

"East End."

The district known as the East End comprises the 13th to the 23d wards inclusive, and covers an area of 21.96 square miles, much of which is but thinly populated farming country. It contains a population of 77,000. The portion which particularly concerns us from a sanitary standpoint is the plateau on which are located East Liberty, Shadyside, Bloomfield, Bellefield, Oakland and Homewood. This plateau, geologists tell us, was formerly the bed of the Monongahela river, at an epoch when its prism occupied a plane 220 feet above its present elevation. Large portions of it are level and marshy, and it is practically without drainage or sewerage; water stands in many of the cellars, and the cesspools overflow. Even the densely built up portions, are obliged to rely solely for drainage upon open ditches, which usually debouche into swamps in vacant lots.

This district contains 55.45 miles of paved, and 170.89 miles of unpaved streets.

Its sanitary condition is bad, the great need being drainage and sewerage. This would probably be a good locality in which to test the merits of the separate system as devised by Col. Waring.

"Southside."

The Southside comprises the 24th to the 36th wards inclusive. It lies along the south banks of the Monongahela and Ohio rivers, contains an area of 5.22 square miles and a population of 56,000. More

than one-half of its total area lies upon the top or slopes of a precipitious range of hills, the base of which approaches, through a portion of its extent, almost to the river edge.

The greater portion of the population is located upon the crescent-shaped bottom known originally before incorporation as the borough of Birmingham, etc. Here fully 30,000 people are crowded upon 700 acres. This locality is but illy provided with drainage and sewerage, although at no point is the Monongahela river more than one-half mile distant from the base of the hills. Of the 700 acres included in this portion, more than 100 acres are built over made ground, formed by the deposit of ashes, chiefly from glass manufactories, largely mixed with street scrapings, and general garbage. The depth of this deposit varies from 3 to 20 feet. In recent years, this district has been visited with epidemics of diphtheria and typhoid fever.

The Southside contains 23.83 miles of paved, and 52.04 miles of unpaved streets.

The sanitary conditions of the populous portions is not good, through lack of proper drainage and sewerage, and also many wells continue to be used.

General Condition.

While the city of Pittsburgh as a whole, exhibits a creditably low death-rate from preventable diseases, this is mainly due to the fact that much of it is rural, and that much of the densely populated portion, notably the Old City, is exceptionally favorably located as regards drainage. The percentage of deaths from preventable diseases on the total mortality in each of the *three* divisions of the city for the past ten years, was as follows:

Old City,	22.0
East End,	23.6
Southside,	31.8

The Old City contains 33,000 inhabitants to the square mile, the East End, 3,000 and the Southside, 10,000. Notwithstanding this great difference in density of population the Old City compares almost equally well with the East End, and presents a much more favorable exhibit than the Southside.

Water Supply.

The water supply of the Old City and East End, as shown by chemical analysis, is excellent. It is obtained from a point in the Allegheny river several miles above the populous portions of the city. It is sufficiently clear not to necessitate the use of filters, the reservoir capacity being sufficient to allow settling. For this reason, citizens where city water is furnished, are not prompted (as upon the Southside) to resort to wells and springs in order to obtain clear water. The works are capable of supplying 45,000,000 gallons daily. The daily consumption is 23,000,000 gallons.

The Southside is supplied by a private corporation, with water from the Mononaghela river. This water although possessing a high degree of purity, chemically, is, for lack of sufficient reservior capacity, furnished the city in a condition so muddy that the citizens often resort to wells and springs in order to obtain the clear but dangerous water furnished by them. This is particularly the case when the river is high and muddy as during the spring floods. Epidemics of typhoid fever have been unerringly traced to this source. Many of these wells and springs have been condemned, and their use abandoned. Efforts are now being made to introduce the city water supply to the Southside, which, if successful, will effectually remedy this sanitary defect.

Infectious Diseases.

Physicians are required by law to report to the health department all cases of *small-pox*, *diphtheria*, *scarlet fever*, *typhoid fever*, *typhus fever*, *yellow fever*, *cerebro spinal fever* or *asiatic cholera* which may come under their care, giving the residence (street, number etc.) of patients.

Bulletins containing a list of cases of small-pox, scarlet fever, and diphtheria, with the location of the same, are sent daily to all the schools in the city, both public and private. School authorities are required to prohibit the attendance of pupils from infected families or houses, until thirty days have elapsed after the convalescence or death of the persons so affected, this to be certified to by the attending physician. Pupils are also required to present a certificate of thorough vaccination before being admitted to any of the schools.

Needed Sanitary Requirements.

The most needed sanitary requirement in our city, is the systematic removal of garbage. This subject has already been alluded to in speaking of the Old City.

The health department has labored earnestly for years in this direction, and it was hoped that in view of the impending cholera invasion the city councils could have been induced to furnish the health department with the funds necessary to put it in successful operation. By no other plan can cellars, cesspools, yards, alleys and vacant lots be kept clean. Washing the main thoroughfares will not reach the points where sanitary work is most needed.

During 1885 a thorough and systematic sanitary survey of all the houses in the city was made by the health department. This important work is being continued during the present year, special attention being given to the condition of cellars, yards and privies.

Inspection of Food.

The health department intrusts the inspection of meat, milk, and other perishable foods to one individual. This work is too extensive for a single official, no matter how competent or energetic he may be,

to successfully carry out. It is simply impossible for him to exercise a constant supervision over the one hundred slaughter-houses scattered throughout the city, and attend to other duties in addition. Vigorous efforts are now being made for the establishment of an "abbatoir" at or near the central stock yards, for the slaughter of crippled, and disabled animals. This if successfully accomplished will greatly facilitate the proper inspection of meats, but should be supplemented by the establishment of additional general slaughtering houses, and the abolition of the smaller ones, many of which are, on account of location, and manner of construction, nuisances of the worst character.

HOSPITAL ACCOMMODATIONS.

It may be a matter of surprise to the world outside to know that the large and wealthy city of Pittsburgh contains no hospital accommodations (other than private) excepting the building under control of the health department, devoted to the use of small-pox patients. During the last epidemic of small-pox, a new addition was built to the old structure, which was not completed until near the subsidence of the disease, and consequently has never been used for the care of small-pox patients. This building, capable of accommodating thirty, is all the city will possess for the care of patients in case of emergency, arising from the advent of cholera.

XXII. The Water Supply of Philadelphia.

By J. CHESTON MORRIS, M. D., *of Philadelphia.*

Some statistical people, in estimating the civilization of any nation measure it by the number of yards of muslin required by the average individual. Much more rational it would seem to me to measure it by the daily average supply of water required. To enumerate the various needs which this gift of nature meets, would tax both time and patience. Suffice it to classify them under the three heads of nutrition, cleanliness, and manufacturing purposes. With the two former classes we as sanitarians are more especially concerned, and to these I would invite your attention. As an aliment, it is necessary that the water we drink should be free from noxious qualities, and yet that it should hold in solution such saline and earthy constituents as shall tend to the building up of the tissues of the body, and promote the healthy exchange of elements of which the tissues are composed, replacing worn-out, effete matter by fresh. Were it essential only to provide a pure water, we could obtain a sufficient supply for our needs by the construction of rain-water cisterns, to be filled by the bounte-

ous showers which vivify and fructify all habitable lands. The water thus obtained is not indeed absolutely pure water; it has been shown to be charged with gases, and even some ammoniacal salts, as well as dust particles, etc. The latter may to some extent be filtered out; but the resulting liquid is not refreshing to the taste, and is wanting in those ingredients which promote tissue metamorphosis and development. Hence this method is only to be resorted to "faute de mieux."

When rain falls on the surface of the earth, a large part of it is absorbed and percolates through the soil and rocks, becoming charged with the various elements it meets with according to their amount of solubility. The chemistry of nature is beyond our power to follow or to imitate, except in some instances "longo intervallo." We know mainly its results in the bubbling springs and fountains that run from the hills. How refreshing and vivifying is such "living water!" To it we are apt to turn as the best type of what we want for our daily supply.

Spring Water's Imperfections.

But let us look a little closer. Not only has the rain water acquired the saline materials and earthy salts which we need; there is also generally in spring water an amount of animal life which shows that the beings of humbler organization than ours have been disporting in it by the thousands. Think of the brownish sediment in the spring, and of the abundance of decaying vegetable matter to be found constantly accumulating there, and you will soon be convinced that spring water is not and cannot be the best type of potable water. Think again of the crayfish, the dead larvæ, the caddis worms and other forms of life, whose excretions and decomposing bodies are to be found there, and you will need no further proof that we must seek elsewhere.

If still skeptical, let me remind you that navigators when seeking supplies of water for crews on long voyages find that such water, when allowed to stand, undergoes a species of fermentation; it becomes "sick," emits a nauseous odor, is more or less ropy, and finally deposits a sediment. After this has occurred, the supernatent fluid once more becomes wholesome and sweet. A number of years ago, I had sent me for analysis some water obtained from wells in a district where typhoid dysentery was raging. The region was a limestone one, with fissures through the rocks, draining all the country into the Susquehanna river. This was evident from the fact that the amount of water in the wells depended on the height of the water in the river. When certain rocks in the latter became bare, typhoid dysentery became epidemic, so that the rocks came to be known as the "Doctors' Marks;" nor was the reason far to seek. A glimpse through the microscope showed a world that would delight a Leidy or a Koch. Through the

summer the minute organisms reveled and multiplied, and their dead remains settled and accumulated at the bottom of the pools. When the drought of July and August brought the well bucket into the sediment, a disease-producing element became the beverage of every household. If any one wishes to see this for himself, it can easily be done by allowing a pitcher of spring water to stand for a few days and then carefully examining the slimy sediment which will form.

STREAMS AND LARGER RIVERS.

Let us follow the water in its course to the streams and larger rivers and note the changes which occur. Nature establishes vast aquaria, in which plants and animals of larger growth abound and balance each other. Our experiments on a smaller scale show us how the animal and vegetable life may be made to balance each other, each supplying what the other needs, and removing the material resulting from the life of the other which would otherwise be noxious to it. Not only is this process going on upon a scale too vast for us to imagine, but in our streams and rivers another agency, or rather two agencies, are at work whose results would pass our belief, had we not the most convincing proofs of their potency. I refer to *aëration* and *subsidence*. In the brooks and streams the water, as it ripples over the stones, becomes charged with oxygen—the organic matters it contains are changed—it parts with some of its carbonic acid, and as it is filtered among the coarse gravel and stones, and meets with waters containing other earthy salts, deposits are formed which, when the water moves again more slowly, subside to the bottom; and, freed from its burden, the water in the river becomes again life-giving—life-sustaining. Hence, when we would seek for the best supply for a large city we should seek for it in a large stream or river, where these processes of duration and subsidence have had full opportunity to do their beneficent work. But it is not to be forgotten that man may mar this work of beneficent nature. When the river or stream becomes the receptacle of filth and excrement, of decaying matters, or of the poisoned refuse of factories, it is no longer health giving, but may even become pestilential. Not only drinking from it, but breathe the tainted air above it, is the cause of disease and death. It is not my purpose at present to more than allude thus generally to these sources of danger to a community. The allusion is sufficient to enforce the necessity of avoiding the danger. Miasmatic, typhoid, and choleraic diseases afflict communities which disregard the purity of their water supply and surroundings. These sources of contamination are susceptible of being guarded against. Sewage even from the largest towns can and should be prevented from entering the rivers on which they are placed. It is no longer an experiment, but an experience, that it can be profitably handled, and thus become a source of revenue

instead of a cause of disease. It would be beyond the scope of this paper to adduce the proof of this from the experience of Manchester in England, Paris in France, and several of our New England towns.

Salts in River Waters.

Another point to which attention should be paid is the character and amount of earthy salts, etc., which are present in the water of rivers, and largely influence their character for usefulness or the reverse for drinking purposes. As already alluded to, these salts possess great advantages when present in due proportion in regulating and controlling the metamorphosis and growth of issues. Potash, soda, lime, magnesia, iron, sulphates, and chlorides are essential constituents of our bodies. If not present in sufficient quantity in our food and drink, they must be supplied as medicines. If, on the other hand, they are present in excess, or in undue proportion, irritation of the system results. Various mineral springs have often their use in removing from the systems of those whose sedentary lives, or excessive indulgence in food, have rendered their blood overloaded, with effete matter. Others again supply material which has been wanting in an assimilable form. Thus it is seen that a water may be too free from inorganic salts—as some have supposed that to be which supplies the city of Glasgow. It is drawn from Loch Katrine, and contains only a small proportion of earthy matter. Or, again, magnesian salts may be over-abundant, as in the water supply of Paris. Those who have tasted it will recall how inefficient it is to quench thirst. Or, like the waters of the Croton or Cochituate, such a proportion of chlorides may be present as to irritate the kidneys and bowels. The effect of a carbonate of lime water in producing diarrhœa with those unaccustomed to its use, is also known to all. The presence of chlorides is also dangerous if the water be conveyed in leaden pipes, as minute quantities of lead are dissolved in it, through their action, while the insoluble sulphate of lead, which soon forms from our Schuylkill water, for instance, constitutes an impermeable safeguard against this danger.

Our best guide as to what is the best proportion of these mineral ingredients is an enlightened experience.

Application to the City's Supply.

We come now to the application of the above facts to the consideration of the water supply of Philadelphia. With a population of nearly one million of souls, eighty million gallons daily is our present need. But estimating the probable increase of the city in the near future we shall soon need one hundred and twenty millions daily. Nor is the present condition of our supply reasonably satisfactory. We have been threatened in summer with water famine. The present works are taxed to their full capacity, and the water flowing through our mains

is frequently muddy. This condition of affairs is largely due to the delay in erecting the large subsiding reservoirs which have been time and again recommended by the various engineers and others who have had charge of our water supply. To give the reasons for this delay hardly comes within my province; but I think it a worthy subject of earnest congratulation that at length there is a prospect of the East Park and Cambria reservoirs being pushed forward to speedy completion. More are needed, as when these are added to those already existing we would only have storage capacity for ten or twelve days' supply. When an opportunity has thus been offered for subsidence of the earthy impurities, much, if not all, reasonable complaint of its occasionable muddy character will have disappeared.

If, as I have endeavored to show, large cities should depend mainly on large streams or rivers for their supply, we should then have to choose between that furnished by the Delaware and Schuylkill, or upon supplies furnished through long aqueducts. The latter are not to be regarded as favorably as the former, other things being equal, from a sanitary point of view. In this matter we may learn a lesson from the experience of New York and Boston. The influence of sunlight and air upon the water are wanting in this mode of transmission, and the result is sometimes a deterioration in quality. Long acqueducts also entail heavy expense, both for construction and repair. They are necessary when no better means can be devised. But how much better it would be should the city of Philadelphia control the whole watershed of the Schuylkill—accumulate in suitable storage reservoirs upon its larger tributaries a sufficient supply to meet any emergency, and utilize nature's purifying processes of aëration and subsidence in its whole length. Dams could be constructed, and streams such as the Upper Perkiomen impounded and their contents released into the river as occasion demands, or the water could be brought directly by gravitation into the Cambria reservoir through an aqueduct, if this should be deemed advisable. Ultimately this aqueduct could be extended to the Upper Lehigh region, or a short tunnel could bring water into it from the Tohickon, and an increased supply obtained thence.

Such would be the possibility of a good and sufficient supply for our city in the distant future. But in the present and immediate future, the supply which could be drawn from reservoirs and storage dams thus constructed on or near the Schuylkill would be ample and of excellent quality. On this latter point we have the testimony of chemists who have examined the waters both of the Schuylkill and Delaware. While the former is, indeed, rich in mineral matters, the latter has a larger amount of organic matter. The abundance of lime sulphate in the Schuylkill has been alleged as a disadvantage. This I have tried to show is a mistake. Owing to the source of this lime salt, *i. e.*, the water of the upper Schuylkill being charged with acid water from the

coal mines, coming in contact with the limestone water above Reading, a precipitation of sulphate of lime occurs which carries with it much of the impurities contracted above. Thus, an explanation is afforded of the statements of Colonel Ludlow and Professor Leeds, that the river is found in its best condition near Phœnixville.

Objection has also been made to the Schuylkill water on account of the increase in the amount of these earthy salts, which has corresponded with the development of coal-mining in the Schuylkill region. But already a change has begun in this respect, and the water seems to have attained the maximum amount of such change, owing to the active mining operations having been transferred from the Pottsville coal field to those lying to the west and north. The same causes may hereafter affect the Lehigh and Susquehanna. Another, and at first appearance a more serious objection, has been made to the Schuylkill as the source of our supply, the much denser population now inhabiting the basin of the Schuylkill than that of the Upper Delaware. This, however, seems to me to be more specious than real. The population of the Schuylkill has, owing to the stimulus of the coal and iron industries, reached a point approaching its maximum, and, as these are developed elsewhere, the future increase will be relatively small. Such as it now is, mainly congregated in the cities of Norristown, Phœnixville, Reading, Pottstown and Pottsville, sewage works can readily be established, which will effectually free the river from contamination from this source. When we think, on the other hand, of the factories and furnaces scattered along the Lehigh, of Easton, Bethlehem, Mauch Chunk and the rapidly developing industries of that region, to say nothing of the other towns and cities on the Delaware, I think it must be evident that nothing less than an aqueduct to bring water from the Delaware above the Water Gap can meet our wants, even were the water there proved to be as good and potable as that which now flows by us at Fairmount. As a matter of fact and experience it should be remembered that the much abused Schuylkill water has been found adapted to their varied uses by the large manufacturing establishments which have made this city the great manufacturing city of the world. So much for its adaptedness to manufacturing purposes.

The Schuylkill's Advantages.

My proposition then would be, that the city should acquire and retain control of the whole Schuylkill watershed for the purpose of securing in perpetuity a good and sufficient water supply, and erect such storage dams and reservoirs as would allow of proper aëration and subsidence and the maintenance of a good quality and quantity at all times. And that there should be a warden or wardens of the river appointed, whose duty it should be to secure the stream from pollution in its whole length from Fairmount pool up.

This plan of utilizing the Schuylkill basin would therefore have the following merits:

1. It would not cost any great immediate outlay.
2. It would be immediately available.
3. It would yield an abundant supply.
4. It would be a financial advantage to the city.
5. A warden of the Schuylkill could be appointed to insure the freedom of the stream from pollution. Such an officer could be created by the Legislature, or under existing laws the city could appoint commissioners whose duty it should be to secure this object. But in order to do so all sources of pollution coming from within its own domain must be removed. The intercepting sewer must be completed and used, and other like means adopted.

In the future the main pumping should be at Flat Rock, saving twenty-two feet elevation. This alone would soon save cost of transference of the works from Fairmount Park, or the erection of new pumping machinery, the present plant being allowed to remain to fill the Fairmount reservoirs and for subsidiary uses, such as for flushing streets and sewers and in case of fires. The early completion of sufficient storage and subsiding reservoirs is to be looked upon as demanded alike by all the plans hitherto proposed; and we cannot be too earnest or active in hastening their construction. There would then be no difficulty should the city possess control of the water power of the Schuylkill in filling these by pumping by water—while the river is high—which would prove a great source of economy.

In support of the views above stated as to the effect of æration and subsidency, I would refer to the report of Colonel Ludlow on the future water supply of the city, and the results obtained by him from the analyses made by Professor Leeds. While he does not recommend the Schuylkill, but on the contrary maintains that the water from the Wentz farm, or the South Mountain plan, or the upper Delaware is better, yet he acknowledges that the water taken near Phœnixville "represents the Schuylkill at its best," *i. e.*, after the natural processes of aëration and subsidence to which I have called your attention; and that it is a good water. One of the samples of Schuylkill water analyzed for Colonel Ludlow, in which the ammonia was so remarkably high, was obtained, I am told, in the afternoon from a pool in which a herd of cattle had been standing all day! One such fact is ample to point to the necessity of such an officer as I have proposed, whose duty it should be to see that no fouling of the stream, whether by human or other animal excretion, or by factory refuse, should be allowed. When this is done and subsidence reservoirs provided, there will remain no reasonable cause of complaint of the supply from our noble and beautiful river.

What more or better can be said of it than that the city of Philadelphia has thriven upon the water supplied from it for one hundred

years—steadily increasing in health and prosperity? Our annual death-rate is lower than that of any larger city except London; and, so far as I am informed, our manufacturers, even in spite of its alleged hardness, desire no better quality than it now affords. Except for the *preventible* sewage contamination, such as I have allued to, there is, in my belief, as based upon our long experience and the results of chemical analyses of Professors Boyé, Booth and Garrett, and even those of Professor Leeds, no better supply to be had, or that need be desired.

XXIII. On Wholesome Water for Cities and Towns.

By Charles Smart, M. D., *Major and Surgeon U. S. Army.*

The purest and most wholesome natural water is derived from springs that are distant from human settlement. The rain-water, falling from the clouds and precipitating with it the impurities that have accumulated in the atmosphere, is absorbed by a porous stratum of the earth's crust through which it filters until it again reaches the surface as a clear and sparkling spring-water. During this process of percolation through a virgin soil all causes of turbidity are removed, and the nitrogenous organic matters existing in solution are converted ino harmless inorganic compounds. In its progress the water becomes more or less charged with inorganic gases and mineral salts, but these, so long as they do not interfere with potability and economic uses, are not only harmless, but endue the water with a wholesome sapidity.

The early settler went to the spring for his water or tapped the water bearing stratum at his own threshold; but this latter mode of obtaining a supply came in time to be attended with the danger of a contaminated inflow. The foully saturated soil of our growing settlements at the present time renders it imperative that we either go to the springs, like the early settler, or have the spring water brought to us. In choosing the latter method, a certain deterioration in the quality of the supply is accepted in part payment for the convenience of tapping the springs on every floor of our houses. The waters of many springs have to be impounded, or those of innumerable springs have to be pumped up from the flowing river. In either case the percolated waters are mixed with a surface inflow, the purity of which depends on the character of the surface which conveys the rainfall. A strict surveillance over the limited water-shed of impounded springs may protect the supply from all impurities, save those precipitated from the atmosphere and the vegetable and mineral matters washed from the surface of the soil. When the water is taken lower down

from the river current, the impurity is increased, because the larger area of the water-shed cannot be so well protected from the harmful effects of its settlement. Besides vegetable decay and fine mineral particles, a certain quantity of the waste of human life and human industries will contaminate the supply. Vegetable matter washed down from the uplands or draining into the current from stagnant ponds, swamps and marshy bottoms, and animal matters contributed by the sewage of the upper settlements are the dangerous substances that enter the water supply derived from the river current.

The chemist can determine with accuracy the elements of the organic matters in a water. He can in many cases state whether they existed mainly in the form of vegetable or of animal matters, and in certain cases he can point out the existence of recent sewage; but he cannot state whether the organic matter discovered is of a harmless or a deleterious character. Ordinary or non-specific vegetable matters are apparently harmless in water, unless present in such quantity or in such a state of fermentative change as will give an observable taint to the supply. So with ordinary or non-specific animal matters, among which are included those known to exist in what has been called *healthy* sewage. But certain specific organic matters, sometimes present, are known to be exceeding unwholesome. These are well recognized facts. Unfortunately the chemical processes fail to differentiate between the ordinary and the specific organic matters. The dictum of the analyst is based upon the assumption that where there is a large impurity the likelihood of a specific accompaniment is greater than where there is a small impurity. His results may authorize a verdict of probable unwholesomeness; but in no instance in which the sense of smell or taste is unaffected, can he be more explicit on this side of the question, and in no instance whatever can he give an assurance of wholesomeness.

On the other hand, when the laboratory results are compared with the data furnished by a thorough investigation into the sanitary aspects of the case, a new light is thrown upon them by which much of their ambiguity is removed. But by sanitary investigation is not meant a mere survey and enumeration of the sources of polluted inflow, but an inquiry into all the points which bear upon the propagation of disease by the water supply, and especially for those diseases which the collected experience of the medical profession has indicated as connected with a polluted water. The indigenous diseases thus associated are not numerous. They consist of fevers that are more or less continued and of fevers that are essentially paroxysmal in type—of typhoid fever and of malaria fevers—the one intimately connected with an *animal* impurity in the water, and the other as intimately connected with a *vegetable* impurity.

The incompetency of the chemical processes to pronounce on the unwholesomeness of a water is more frequently illustrated when ani-

mal matter is in question. Waters comparatively free from vegetable impurities have never been accused of malarial possibilities—while waters largely thus contaminated have often been so charged and adjudged guilty. But a water which has been the apparent propagator of typhoid fever may or may not be found foul on analysis; and waters manifestly foul from sewage inflow have been used for long periods without producing an injurious effect. The recent records of medicine are full of instances in which a well with sewer or cesspool connections has been used for years with no harmful results so long as the sewage inflow was small and of an ordinary or non specific character; but as soon as a specific infection was added, the well has become a center of typhoid propagation. Whether the specific infection is always derived from the intestines of an antecedent case of the disease or is generated in an impure soil under certain conditions is immaterial to the present argument. It is sufficient to know that the infection is present in the typhoid excreta, and that, when any of this infected matter percolates into the well, fresh cases of typhoid fever are developed in susceptible persons, who make use of its waters for drinking purposes. Usually in such wells the sewage inflow is so great that the chemical results show an undesirable contamination; but in many instances the inflow is so small, or the purifying influence of the percolation through the soil is so great, that the infected water may give a fairly good showing on its analytical record. In other words, the quantity of infected sewage necessary to the spread of typhoid by a well-water is so small as to evade detection by chemical methods, or the influence of a filtration, which effects the destruction of ordinary organic matter, leaves the specific poison unaffected and in full potency. So well are these facts recognized and acknowledged, that the health officers of many cities having a trustworthy general supply, have not hesitated to close up the wells within their jurisdiction.

It has been said at the beginning of this paper that the purest natural water is that which has been filtered through a clean soil. The organic matter is reduced to an inorganic condition. It becomes split up into transitional and unstable forms, the changes terminating in the rapid nitrification of a produced ammonia. A water thus purified may yield but little free or albuminoid ammonia on analysis, and even the nitrates that remain to indicate the former sewage pollution may constitute an apparently trifling quantity; but this water, pure according to the analytical record, may be a dangerous propagator of enteric fever if the sewage that has been destroyed was an infected sewage. The purifying influence does not affect the fever-poison, nor does the filtration remove it.

Now, if the infection of an infected sewage be not separable by filtration, and can withstand the powerful agencies that in the process

of filtration destroy the accompanying sewage, will the infection of an infected sewage poured into the current of a river be destroyed by a flow of so many hours in that current? Will that which cannot be separated by filtration be removed by subsidence in a flowing stream which is often manifestly turbid? Will that which is not destroyed by the most powerful of natural purifying influences be rendered inert by the weaker influences operating on the flowing water? If not, river waters that have been polluted with an infected sewage will communicate typhoid fever as surely as well waters that have been similarly contaminated,—and wholly irrespective of the results of chemical analysis.

Chemists, looking only at the laboratory results, have announced that the running water becomes purified as it flows, and that at a certain distance below the point of sewage inflow it becomes again as free from organic matter as it was before the introduction of the contamination. A distinguished authority in this country has spoken with emphasis on this point: "It should be distinctly stated," he has said, "that there is no foundation in fact for the oft-repeated statement that water once polluted by sewage can never again become safe for drinking purposes. Wherever the pollution and subsequent self-purification of a flowing stream has been patiently investigated the chemical testimony as to the reality of this self-purification has been convincingly demonstrated." But the conclusions of the English Rivers-Pollution Commission are opposed to this claim. "It will be safe to infer," it is stated, "that there is no river in the United Kingdom long enough to affect the destruction of sewage by oxidation." Nevertheless, self purification, to a certain extent, may be accepted as a fact. Dilution, sedimentation, aëration and nitrifaction go on in the current, and all that tend to improve the analytical record of the water; but the chemical testimony which convincingly demonstrates the reality of this self-purification does not demonstrate the safety of the water for drinking purposes. Dr. Buchanan, of England, summing up the results of a recent investigation, stated that we have no evidence in the case of an unknown water that it is safe organically, although the chemical testimony may place it in the list of waters of extraordinary organic purity; and, practically, the same conclusion was reached by the investigation conducted in this country by Professor Mallet, of the University of Virginia.

To demonstrate that a water which has been polluted by an infected sewage may again become safe for drinking purposes, it is needful to show that typhoid fever is not a prevailing disease among the people who use it. There are many difficulties in the way of effecting this demonstration, and chief among these appears to be the well attested fact that typhoid fever does prevail among them, and in many recorded instances has been traced to the water as its source. Witness the epidemic of last year at Plymouth, or the Lausen epidemic, in

which the water underwent a thorough natural filtration before propagating the disease. There is no difficulty in showing that typhoid fever prevails among people who use an infected water; but it is often extremely difficult to prove the charge against the water. We may appeal to statistics, but our statistical records are not always trustworthy. The typhoid influence of a general water supply may be modified by that of a supplemental supply from vitiated wells. Water carriage is not the only method by which typhoid is propagated. Not long ago sewer air was regarded as an ever present cause in our cities, and there seems no doubt that infected exhalations contribute to the prevalence of the disease. Secondary foci from primary cases may give rise by mediate contagion to local epidemics which obscure the influence of a weakly infected water supply. Nevertheless, there are some points, other than those already mentioned, in the natural history of the typhoid poison that countenance the belief in its propagation by contaminated river water. Typhoid fever differs from smallpox, measles and scarlet fever in having no cyclical prevalence. It is not a rare clinical study and sanitary anxiety at one time and a prevailing epidemic at another. Where many people are aggregated, its causes are always present and always in operation. But it has a well developed seasonal tide in its prevalence, which spreads its maximum in this country over the latter half of the third and the first part of the last quarter of the year. Dr. Baker, of Michigan, has shown that in his State this increased prevalence follows a low stage of water in the wells, when sewage inflow is less diluted than at other seasons. But the same period of prevalence holds good in the cities which have a general water supply, corresponding with the time when the sewage inflow into the streams is in like manner undiluted.

Again, in looking at the typhoid statistics of certain cities, in which the complicating elements appear to be at a minimum, we cannot fail to be struck by the fact that the prevalence of typhoid fever is in a measure proportioned to the sewage pollution of the water supply. It is to be noted in this connection that although a given sewage may not be an infected sewage, it must be regarded as possessing the elements of danger in view of the general distribution of the fever in rural as well as in urban districts.

Brooklyn, Long Island, has a water supply perhaps less contaminated with sewage than that of any large city in this country. It has also a smaller rate of mortality from typhoid. Last year 23 persons died of this fever in every 100,000 of the population. This is not an accidentally small rate due to the absence of an epidemic during that particular year, for the average annual rate of the last ten years was only a little over 15 per 100,000. The city of New York has a water supply that is guarded with much care from sewage inflow, but it is derived from a much more extensive area than the Brooklyn water. The typhoid death rate last year was 21, and the average annual rate

for the past ten years 26. A constant supervision is exercised over the water supply of the four millions of people aggregated in the city of London, England; and the mortality rate of the continued fevers, including typhus, amounted only to 17 during the past year, while the average annual rate of the past ten years was but little over 28 in the 100,000. These figures may be regarded as a standard of comparison for the rates of other cities.

The water supply of Boston has a careful superintendence, but it is known to have a certain amount of sewage inflow. Correspondingly we find that the typhoid mortality rates are higher than those already instanced. The rate for 1885 was 38, and the average of the past ten years 43. Cincinnati, supplied by the Ohio river, gives higher typhoid rates: 44 for the past year, and 63 as the average of the past ten years. Philadelphia, supplied chiefly by the Schuylkill, had a typhoid rate of 64 in 1885, and an average rate of 66 for the past ten years. These rates for Philadelphia mean that during the past ten years there died of typhoid fever 4,400 persons who would not have died of that disease had the Brooklyn rates prevailed; and that over 50,000 people suffered from a dangerous and debilitating illness who would have escaped attack had Brooklyn causes operated on them instead of those of Philadelphia.

If the views that have been submitted are correct, we would infer the presence of an infected sewage in the Schuylkill water, or the presence in Philadelphia of typhoid causes that do not exist in Brooklyn, New York or London. According to the records of the water department of the city a notable sewage inflow has existed since 1860, when complaints were made of the foul taste and color of the water, and when certain sewers were specially mentioned as occasioning the impurity. A recent report says:

"The Schuylkill above Fairmount dam is the natural sewer, first and last, for a population of 350,000, largely engaged in manufacturing; and whatever may be the varying judgments of physicists as to the power of a running stream to purge itself of foreign contamination, it is very certain that the river itself has, from time to time, furnished the most convincing evidence of its inability to digest or dispose of the extraneous and injurious matters discharged into it."

With regard to other assumed causes of typhoid, it does not appear that Philadelphia is specially their habitat. The aggregation of susceptible individuals on a given area undoubtedly facilitates the spread of this disease; but the area of Philadelphia is less crowded than that of most cities of its size,—certainly less so than that of New York or London. The progress of sewer construction has kept pace with the growth of the city. It has been demonstrated by many statistical comparisons that the introduction of a system of sewerage has invariably lessened the death rate of a city, and particularly the rate occasioned by the zymotic diseases; yet Philadelphia, so far as regards

typhoid fever, retains or even exceeds the rates that prevail in certain unsewered cities.

The following table shows in parallel columns the annual death rate from typhoid fever per 100,000 of the population in the sewered city of Philadelphia and in the unsewered cities of Baltimore and New Orleans. The rates for each of the past twenty years are given, yielding an average for Philadelphia 61, slightly lower than that for Baltimore, 65.4, and considerably larger than that for New Orleans, 33. When we restrict our inquiry to the rates of the past ten years it is found that Philadelphia has a higher mortality than either of the two other cities, 66.1, as compared with 52.5 and 24.6. The soil of Baltimore is honey-combed with pits and vaults of deposit; and although the city has had a general water supply for many years, the well-water supply has been used to a considerable extent. I have but little personal knowledge of the character of these well-waters. In 1879, I examined one of them, situated in the enclosure of the Johns Hopkins University. It was rather a rank ammoniacal solution than a potable water. The use of such waters may be held in view in regarding the rate of the first of these periods of ten years. In 1880, an additional supply was brought into the city from the Gunpowder river, and perhaps the consequent disuse of contaminated wells may account for the lessened frequency of typhoid of late years. At the present time there are 62 public wells in use, 13 of which are artesian; all the others have been condemned and closed. There are, however, many private pumps which are not under the control of the health commissioner. These, with a trifling amount of sewage inflow into the waters of Jones' Falls and the Gunpowder river before they reach the storage lakes, may be held responsible for the typhoid prevalence at the present time. The sanitary condition of New Orleans will be referred to hereafter.

Annual Death Rates from Typhoid Fever per 100.000 of the Population in Philadelphia, Baltimore and New Orleans.

	Philadelphia.	Baltimore.	New Orleans.
1866,	60	80	65
1867,	57	94	66
1868,	60	65	31
1869,	56	80	34
1870,	61	99	42
1871,	45	73	37
1872,	52	65	34
1873,	50	82	29
1874,	62	83	47
1875,	55	62	28
Annual rate for the decade—,	55.8	78.3	41.3

ANNUAL DEATH RATES FROM TYPHOID FEVER PER 100,000 OF THE POPULATION IN PHILADELPHIA, BALTIMORE AND NEW ORLEANS.

	Philadelphia.	Baltimore.	New Orleans.
1876,	98	60	26
1877,	68	75	33
1878,	50	55	21
1879,	41	51	15
1880,	59	59	24
1881,	74	58	30
1882,	73	47	33
1883,	63	36	23
1884,	71	42	25
1885,	64	42	16
Annual rate for the decade—,	66.1	52.5	24.6
Annual rate for past 20 years—,	61.0	65.4	33.0

In a valuable article, read last year at the Ypsilanti Sanitary Convention, Dr. Erwin F. Smith has tabulated many of the statistics bearing on the lessened mortality from typhoid, coincident with the introduction of a general water-supply and a system of sewerage. These are usually contemporaneous improvements, but the removal of the filth by water carriage constitutes so notable a change in the sanitation of the municipality that the influence of the water-supply is generally regarded only in so far as it has contributed to that end. Nevertheless, it is a question if the water-supply *per se* be not a more important factor in the subsequent decrease of sickness than the system of sewerage. On its introduction the water is usually of excellent quality. It takes the place of dangerous waters from the subsoil of the city, and contributes proportionately to the typhoid diminution. But, later, as the water-supply becomes defiled by the growth of settlements on the area of its derivation and along its course, it may become as much charged with dangerous matters as the well waters which it supplanted.

To what extent the Schuylkill water supply is responsible for the typhoid rates of Philadelphia is not for me to indicate. Due consideration must be given to all the other influences that are known to favor the propagation of the disease. One of these, the sub-soil water, still operates to a considerable extent, although the board of health has taken action against it and directed the closure of the wells. Dr. Leffmann in a recent paper suggested that the irregularity of the distribution of the deaths from typhoid throughout the city is opposed to the idea of typhoid propagation by the Schuylkill supply; but local epidemics, originating in infected wells, may account for this irregularity without excluding the possibility of a generally diffused

but less marked prevalence. It does not appear that in New York City the disease is confined to any particular locality; its distribution is is general:—and the maps of the health officer of Washington city show an indiscriminate scattering of the deaths over the populated areas.

One other argument in favor of the connection between a sewage-polluted water and the prevalence of typhoid may be derived from the recorded statistics of mortality. If it were possible to build a city with all the sanitary conditions, whatever they may be, that underlie the surface of Philadelphia, and to supply that city with water certainly free from sewage, a death-rate from typhoid in this supposed city equalling that of Philadelphia, would throw the causation of the disease upon other agencies than the water supply; and correspondingly a comparative freedom from typhoid in the supposed city would strengthen the argument in favor of a water propagation for the diseases in Philadelphia. Such a city cannot be built to order; but fortunately New Orleans presents us with many of the essentials of an experiment of this kind. New Orleans has no sewers; all its liquid filth flows sluggishly in open channels by the sidewalks; its more solid refuse is collected in boxes, in closets and outhouses, whence it is carried to the current of the Mississippi; the subsoil water is so impregnated with drainage from the surface as to be unfit for portable use; and the exhalations from the sluggish drains, the closets and outhouses, not unfrequently taint the air in many parts of the city. Here are conditions as to subsoil and surface which would be regarded as accounting sufficiently for an extensive prevalence of typhoid were it found to be present. Certainly they must be considered as more conducive to the spread of zymotic disease than the corresponding conditions of subsoil and surface in Philadelphia, for the general results of modern sanitation show a sewered city to be a healthier abode than one that is not sewered. But this city of New Orleans has a water-supply that is free from sewage inflow. The Mississippi water is pumped up mainly for use in flushing the streets and drains, while the domestic supply consists of rain water collected and stored in cypress wood cisterns which are raised above the suspicion of a contamination by sewage. And the typhoid mortality, 16 during the past year and 25.6 as the average of the past ten years, is as low as the standard rates furnished by the cities of New York and London.

May we conclude from these arguments, that the inflow of sewage into a stream is fraught with too many dangerous associations in connection with typhoid fever to warrant the use of its water as a general supply, no matter how convincing may be the chemical testimony as to its organic purity? Whatever other modes of typhoid propagation may be allowed, that from the sewers and vaults, which are the "continuation of the diseased intestines," is incontestable. The influences operating on the flowing water do not destroy the essence of the disease, nor, as shown by the history of every infected well, does the

process of filtration effect the separation of the poison. The advocates of sewage irrigation become enthusiastic over the clearness and purity of the water that flows from their under-drains, and suggest that the general use of this system for the disposal of sewage would reclaim our polluted streams and permit them to be again used with safety for household purposes. But the essence of sewage irrigation is filtration, and filtration through a notoriously polluted soil. The unwholesomeness of well water in a soil saturated with sewage has been so often illustrated, that we may well be excused for showing some hesitancy in accepting the effluent water of sewage irrigation as a general household supply. The adoption of this system of irrigation would undoubtedly prevent our streams from becoming open sewers; but here the advantage ceases. So long as we know that, not sewage, but a sewage polluted mountain stream used for irrigating purposes in one valley occasioned a general outbreak of virulent typhoid among the inhabitants of another valley, who used the clear water of the effluent, we must acknowledge that filtration cannot be trusted to render an infected water safe. Hence, if the conclusion above suggested be admitted, the only method by which typhoid, communicated by a general water supply, may be avoided is to procure a supply of water that is free from sewage and preserve it in its condition of natural purity.

The vegetable matters in a water appear to be dangerous in proportion as the water exhibits the usual characteristics of marsh or swamp waters. The organic matter in these is comparatively large in quantity, and contains a larger proportion of carbon combined with its nitrogen than is found in animal matter. This is shown in the laboratory by direct analysis, or indirectly by the large quantity of oxygen that is required to oxidize a matter yielding a relatively small quantity of albuminoid ammonia. The microscopic life in these waters is of an elementary form, consisting largely of sluggish protoplasmic masses. Remittent fevers have been frequently associated with the use of such waters. But it does not follow that these vegetable matters in themselves constitute the essence of malarial disease. The accepted theory is that organic matter during its decomposition, under certain conditions in the soil, evolves a noxious miasm. This miasm escapes into the atmosphere and its subtile influence is felt at considerable distances from the place of exhalation. It is known to be condensed and concentrated by fogs and falling moisture, and it seems probable that even the rainfall is not free from a taint of this impurity among the other impurities which it washes from the atmosphere. But, the chief source of a malarial contamination in our surface waters is their contact with an exhaling soil. Hence, although a malarious water may exist without an associated charge of vegetable organic matter, it usually contains a very notable quantity; and this quantity may be regarded as an index of the malarial possibilities of the water.

The propagation of malarial diseases by means of the drinking water has of late years been generally accepted by the profession. Proof was difficult to obtain because of the long continued and unquestioned acceptance of the doctrine of an aërial miasm. When the requisite spot of malarious soil was not present to account by its exhalations for some obscure or anomalous case the existence of such a spot was assumed, for it seemed more plausible to suppose that the malarious locality had escaped recognition than that the time honored doctrine was inadequate to explain all the cases. But when attention was directed to these obscure cases they were found to be very numerous. They were common in all our western territories on elevated grounds where there was apparently no source of malarial exhalations; and these cases were always of a serious character,—remittent fevers rather than simple agues. They were common, also, in our large cities where drainage and cellarage gave a dry subsoil and the surface was more or less sealed by street paving; and these cases also, were of a remitting or sub-continued form. They were common in certain districts of the country in the winter season where the theory of a malarial miasm exhaled into the atmosphere and inhaled into the lungs was inconsistent with their existence, inasmuch as the frosts of the season or a thick covering of snow should have imprisoned all such exhalations; and these cases, also, were found to be severe rather than mild. But in all these instances of serious malarial disease without malarious soils to account for them, the drinking water used was not above suspicion, and in many the prevalence and aggravated character of the sickness was proportioned to the amount of vegetable impurity in the water. On the assumption that the water was impregnated with the malarial essence, these obscure cases ceased to be obscure. But this is not an assumption, for there is a groundwork of observations to support it as solid as that which sustains the theory of aërial transmission. Many years ago a well-known medical investigator reported the occurrence of pestilent malarial fevers among troops on a transport that had been supplied with marsh water. The evidence was so strongly guarded at every point that no doubt could be entertained as to the causation of the fever among these men. Since then dangerous fevers have frequently been referred, on more or less satisfactory testimony, to malarious surface waters; and it is notable that the disease when introduced in this way is always of a more aggravated type than when caused solely by exhalations,—the poisonous water appearing in a general way to be a more concentrated and deadly agent than the poisonous air. Moreover, and this is of grand importance from a preventive point of view, the prevalence of these fevers has decreased with an improvement in the water supply. The remittents of our Western territories have declined in frequency and virulence since the country became settled

and a better water supply was found than that of the ponds, ditches and tanks used by the early overland traveler and settler. The evidence from India is very explicit on a similar decline of the pestilential fevers. Recent reports from some of the most unhealthy districts show an extraordinary change in the insalubrity of the country coincident with the procurement of a supply of drinking water from deep and carefully protected wells. Along the base of the Himalaya Mountains is a broad strip of marsh and forest land called the Terai, which for many years has been uninhabitable owing to the prevalence of malarial fevers. Continued efforts were made by the Government to reclaim and populate this tract, but only with partial success. The strife between enterprise and malaria was carried on, but at the expense of a fearful sacrifice of human life, until recently when the construction of deep masonry wells has permitted positions to be held which a long experience had pronounced uninhabitable. The natives have for ages believed in the transmission of the fever by means of the surface water, and this belief has at last been accepted in its entirety by the Government, and, as reported, with beneficent practical results. Villages that were formerly unhealthy have ceased to be so, and the change has been sharply defined and cotemporaneous with the construction of masonry wells. These experiences fully support the evidence brought by Professor Parkes from the Crimea to the effect that the villagers there who drank surface water had fever all the year round, while those who drank well-water had fever only in the summer and autumn.

All the observations and arguments hitherto advanced in favor of the transmission of malarial disease to the human system by means of the water supply have equal force on behalf of filtering the surface waters that are to be used for drinking purposes. In no instance has malarial disease been traced to the use of well-water untainted by a direct inflow from the surface. Dangerous malarious waters from marshes and other soils rich in vegetable decay leave their noxious constituents behind them in percolating through the soil, and appear in the well as pure and non-malarious waters. Filtration is therefore capable of removing from a surface water the essence of the remittent fevers that may be present in it.

This brief review of the pathogenic relations of the animal and vegetable matters that find their way into our running streams, under the conditions of the present time, teaches us how a certain proportion of the sickness and mortality now prevalent in our growing settlements may be avoided. Spring water issuing from an unsullied soil is destitute of morbific qualities. Nature is bountiful and provides for all the needs of creation in the cyclical repetition of her processes. The waters rise from their great store-house under the influence of the solar heat. They pervade the atmosphere, and massing from time to time, are precipitated, carrying with them the accumulated impuri-

ties that would otherwise soon render the aërial ocean turbid and unfit for the support of life such as ours. They flush the surface of the earth, freshen its verdure and carry into the rivers all the detritus of animal and vegetable life. The river-water is nature's sewage, and its destination is the ocean. The rain-water becomes impure in carrying out the purpose of its fall in the economy of nature; but all its impurities are removed from that part of it which penetrates the soil to feed the springs.

The experience of all the ages testifies to the purity and desirability of the spring supply. When the Israelites were famishing in the Wilderness they obtained manna from Heaven, but their water supply came from the rocks of Massah and Meribah when struck by the rod of Moses.

Under the conditions of our modern civilization it seems impossible to bring the spring water in its pristine purity to our homes, but it is only a question of money and an intelligent and watchful superintendence to have a water which will be its equal in wholesomeness. Animal matter with its typhoid possibilities must be excluded by the selection of a suitable source the area of which must be afterwards protected to the full. But the most careful surveillance will fail to exclude the malarial possibilities associated with the vegetable matter of an otherwise healthful surface. To remove these nature's process of filtration must be imitated. Thus only will a water be obtained free from the danger of typhoid fever on the one hand and of malarial disease on the other,—a pure, clear and wholesome supply, which, by preserving the community from unnecessary sicknesss, will in a short time amply repay the expenditure involved in its introduction.

XXIV. The Quality of the Water Supply of Philadelphia as Tested by Vital Statistics.

By Richard A. Cleemann, M. D.,
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Chemists have attempted to define a standard by which water as a source of supply for drinking purposes should be accepted or rejected, but thus far without conspicuous success. As late as ten years ago high chemical authority declared "that the Schuylkill water is about as good a water as one might wish for a large city," while a year before the same authority speaking of course through a different mouth-piece, found the water occasionally "totally unfit for use," and opined that unless some precautions were taken the visitation of some epidemic was certainly to be expected.

These are certainly very diverse views, but their discrepancy need not astonish us if we reflect that the most that chemistry can inform us with regard to an impure water is, that it contains or has contained an undue amount of organic matter. Whether the organic matter is animal or vegetable cannot be declared, and even if it is quite probable that the contamination is from animal sources, the further question whether this animal matter is harmful or harmless is still in abeyance.

Yet the chemical analysis of water is by no means to be despised; for though, as intimated, the information it gives cannot lead to certain conclusions, it may serve to excite a suspicion which, followed up by research in other directions, will determine the rejection of an unwholesome water.

Sanitarians have come to consider the history of a water as of more importance than its chemical analysis; for laying aside the uncertainty of the precise nature of the organic pollution which chemistry may detect, now, in the reign of the germ theory of disease, it is believed that the disease-bearing microzemes may be borne along, in the waters of a river, for instance, long after the organic matter with which they were accompanied at the outset have been eliminated by aëration, subsidence or dilution. Chemical tests are blind to these morbific atoms, so that it is possible that a water to analysis chemically pure, may yet be a most dangerous article to be ingested.

The analyses of Dr. Charles M. Cresson, Albert R. Leeds, Ph. D., and others having demonstrated a threatening amount of organic matter in the waters of the Schuylkill; the history of the river water as it flows from its mountain sources to our reservoirs has been carefully studied. The latest research in this direction which I have seen, is the "Report of a Sanitary Survey of the Schuylkill Valley," made by Assistant Engineer Dana C. Barber, under the direction of Col. Wm. Ludlow, late Chief of the Water Department of Philadelphia. From this carefully prepared report we learn that the river Schuylkill, in addition to the pollution of its waters in its upper portion, with a total drainage area of 1,863.9 square miles, receives in a distance of 60 miles from the city of Reading to Fairmount dam, the water closet drainage of a population of 22,000 souls and the waste water drainage of 63,000, besides the refuse from scores of manufactories, drainage from cemeteries and the like.

This is not pleasant reading; it convicts the beautiful river, by circumstantial evidence, of murder. Now, in this extremity, can we bring any direct testimony to bear on the case through a study of vital statistics? There is a homely adage which says the proof of the pudding is in the eating; perchance the test of the water is found in the drinking.

An impure supply of drinking water is said by those who have

studied the subject to have the general effect of sapping the constitution of those who use it, making them less resistant to the inroads of disease of whatever kind, an effect reflected in a high general death-rate.

During the last fifteen years (1871–1885 included) there have been 267,603 deaths recorded in the city of Philadelphia; this mortality gives, according to my calculations, a death-rate for the city of 21.87 deaths per thousand inhabitants living, a rate only fractionally different from that of London, England, which was, during that period, the healthiest large city in the world. It is difficult to reconcile this rate with the theory of a grossly polluted water supply. But I have gone a step farther (Table A), dividing the same period of fifteen years into lustra of five years each. I find for the first lustrum a rate of 22.79 deaths per thousand inhabitants living; for the second, 20.63, and for the third, 22.26. From these figures it appears that the increasing impurity of the water is not reflected in an increasing death-rate. This actually decreased for the second period though it increased again in the third, though not then rivaling that of the first period. It is only fair to say, however, and this is an instance of the difficulties met with in analyzing vital statistics, that a great part of the irregularity in the above ratios is due to the disturbing influence of the varying number of deaths from small-pox; if we eliminate these the respective death-rates for the several periods will be 21.62, 20.37 and 21.85. Here there is a slight increase in the death-rate of the last lustrum, but, as there was a much larger falling off in that of the second, no definite significance can be attached to it from the point of view of a deteriorating water supply.

But, a critic may remark, though the lethal influence of the water may be hidden in the general death-rate, it will surely come to light in an increased zymotic mortality. To meet this objection I have calculated the ratios of the number of deaths from zymotic diseases to the number of deaths from all causes during each of the five-year periods already named; they read in chronological order as follows: 25.62, 22.00 and 23.09, given an even more marked diminution in the rate of the last period as compared with the first than was found while considering the general death-rate only. If, however, we eliminate the disturbing influence of small-pox as before, we discover at last a progressive though slight increase in the zymotic death-rate as follows: 20.48, 20.82, 21.24.

But is this increase due to a higher death-rate from those diseases in the zymotic class which are believed to be made more fatal by foul drinking water? To examine this question I have made a brief study of the deaths recorded from such diseases, namely, typhoid fever, diarrhœa, dysentery, cholera morbus and cholera infantum. Along with them I have considered the deaths from "enteritis," including under this term the deaths classified in the health officer's report, as

from inflammation of the stomach and bowels, and congestion, hemorrhage and ulceration of the bowels. For a special reason, which will appear hereafter, I have included the deaths from malarial fevers also. (Table B.)

Now, the combined death-rates of these diarrhœal diseases (expressed in the number of deaths to the 10,000 inhabitants living, instead of to the usual number 1,000), read 29.29, 25.80, 26.62 for the three five-year periods beginning with the earliest and proceeding in order. The decreased death rates in the later periods is not in accord with the theory of a drinking-water becoming more and more impure from year to year.

Of the individual diarrhœal diseases, diarrhœa, dysentery, cholera morbus and cholera infantum have each markedly decreased in fatality during the last fifteen years, while typhoid fever, malarial fever and enteritis have caused many more deaths.

From the circumstance that the very large majority of the deaths classified under enteritis were gathered from under the heading, "inflammation of the stomach and bowels," and the further consideration, which I established by looking at the records of the health office, that the deaths under the latter caption were in more than half the cases of children under two years of age, and occurred chiefly in the summer months; from these considerations, taken in connection with the coincidence in the last two lustra of the decrease in the recorded number of deaths from cholera infantum, it is not unreasonable to suppose that some physicians use these names of disease as interchangeable terms. If this is true, the gain in the number of deaths from enteritis is balanced by the loss on those from cholera infantum; though indeed if the deaths from both causes are added together, the sum gives still a lower death rate from these combined diseases than obtained ten years ago.

Therefore, the point arrived at after this brief survey of statistics is this: That with the exception of typhoid fever all diarrhœal diseases are less fatal in Philadelphia now than they were from ten to fifteen years ago. The deduction is that the Schuylkill water is more free from disease-bearing pollution than it has been in the past, unless possibly as regards the poison of typhoid fever.

But some one may say, that is the capital point; it is the prevalence of typhoid fever which condemns the water supply. Yet typhoid fever causes a good many deaths in some other cities where there is no suspicion of a polluted water supply. There is, however, I believe, a widely spread though erroneous opinion that Philadelphia is afflicted much beyond other large cities in this country from the dread scourge of typhoid.

Let us examine for a moment this point. Take at first the city of New York, the city most closely allied in number of inhabitants and general climatic conditions to Philadelphia. Looking over a comparative

table of vital statistics prepared by the health department of the former city for the year 1883 (the latest I had at hand), I found the number of deaths from typhoid fever in New York city set down as 471. For this year the typhoid mortality in Philadelphia was 579. Considering the larger population of New York, about one-third more, this appears at first sight very serious in Philadelphia. But looking at another part of the New York report I discovered under the heading "Remittent, Intermittent, Typho-Malarial, Congestive and simple continued fevers," 525 additional deaths recorded. Now in the Philadelphia mortality list the deaths from typho-malarial and continued fevers are classed and counted along with those from typhoid. It seems to me fair to presume that the death-rate from remittent, intermittent and congestive fevers does not differ very much in the two cities, and under this presumption a fairer comparison of the typhoid mortality of the two cities is obtained by placing together for each city the deaths as recorded from typhoid and malarial fevers. The number of deaths from typhoid fever plus malarial fevers in New York in the year 1883 was 996, and in Philadelphia 691. These figures, estimating the population of New York at 1,317,691 inhabitants and that of Philadelphia at 967,641, give the combined death-rate from typhoid and malaria fevers in New York as 7.55, and in Philadelphia 7.61, almost identical values. From the same report I found against a mortality from typhoid fever alone in Philadelphia of 6.38; Chicago had one of 6.22 and Boston one of 5.17. Philadelphia is not then so very far ahead of some other large cities of this country in typhoid mortality, and for the year quoted, which I have not taken as an exceptional one, the death-rate from typhoid fever was about the same in Chicago and Philadelphia, though the water supply of the former city is considered to be ideal in its purity. Is there any other general cause more likely than contaminated water to produce the typhoid mortality of Philadelphia? Discussing this question in a report on meteorology and epidemics, I made several years ago, I claimed that the unequal distribution of the deaths through the different wards of the city, giving the appearance of a large number of small local invasions of the disease was opposed to the view of typhoid-poisoned water, which should, in a large population, quite equally distribute the deaths among the several municipal divisions of the town. It seemed to me more probable that the custom of storing excreta, instead of removing it by an efficient system of sewerage, was the cause of the evil.

Dr. Henry Leffmann, in an address before the County Medical Society, going over the same ground for the typhoid mortality of last year, also rejected the theory of typhoid contamination of the general water supply. The final conclusion is that the study of vital statistics negatives the idea of the pollution of Schuylkill water.

Now, gentlemen, what has been my purpose in reading this paper?

To demonstrate as absurd the present agitation in regard to the pollution of the Schuylkill water? Not at all. But from my position in the Board of Health of Philadelphia, I have been asked more than once by persons convinced of the impurity of our drinking water to give them statistics to prove that fact. I have replied that statistics would not show this; but as the question is still urged, I have made this demonstration; but I need not tell practical sanitarians that statistics are gross machinery to sift out the etiology of diseases.

But I had another object in view and that the chief one. To combat feebly it might be, yet earnestly, the spirit of exaggeration with which the impurities of our drinking water are spoken of.

Thanks to the industry of sensationalists, the water of Philadelphia has become a by-word of reproach, a very stench in the nostrils of the nation.

I trust that I have at least shown you that such utter condemnation is entirely uncalled for. Yet it is a duty which we owe to ourselves, as well as to those who come to visit us, to put the purity of the water supply beyond doubt; it should be like Cæsar's wife, above suspicion.

It is, therefore, much to be desired that the counsels of those who urge a new supply from the head waters of the Delaware, or other equally pure source, will prevail.

TABLE A.—*Deaths in Philadelphia, from all causes, from zymotic diseases, and from special zymotic diseases: with population for the years 1871–1885 inclusive; and the same consolidated for the three periods, 1871–1875, 1876–1880, 1881–1885.*

YEAR,	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882	1883.	1884.	1885	1871-75.	1876 80.	1881 85
Population,	691 347	708 612	725 907	743,202	760,497	777,792	795,087	812,382	829 677	846 980	863,000	886,539	907,041	927,995	949 431	3 629 535	4 061 938	4 539 006
Deaths from all causes,	15,485	13,987	15,224	15,238	17, 05	18 892	16 004	15,743	15,473	17,711	19 515	20,059	20,C76	19,999	21 392	82,739	83 823	101.041
Deaths from zymotic diseases,	4 173	6 299	3 134	3,005	4,590	4,777	3 689	3 303	2 837	3 810	5 135	4 573	4 768	4 373	4 484	21,201	18 416	23 334
Small-pox,	1 565	2,580	39	16	56	407	155	0	6	424	1 533	314	173	35	3	4,256	992	1 831
Measles,	41	140	29	117	12	53	69	12	8	108	17	19	58	96	131	339	250	321
Scarlatina,	262	168	309	352	1 032	328	379	554	336	290	486	310	561	549	375	2,123	1 887	2 272
Diphtheria,	145	141	106	181	656	708	458	464	321	323	457	933	1 006	630	600	1,229	2 274	3 676
Croup,	264	284	183	196	429	386	338	388	291	333	317	436	500	589	753	1 361	1 706	2 625
Whooping cough,	81	155	95	74	125	88	81	109	103	101	113	63	86	107	144	530	482	513
Typhoid fever,	313	341	358	463	400	774	542	404	344	495	645	650	579	662	610	1 880	2 559	3 150
Typhus fever,	37	35	31	26	21	27	15	9	1	23	12	3	36	2	1	150	75	54
Erysipelas,	57	76	89	83	87	84	77	67	83	63	75	64	85	69	88	392	374	331
Puerperal fever,	28	22	28	65	80	54	50	47	41	26	39	22	24	28	41	223	218	154
Dysentery,	97	75	73	49	78	78	79	51	60	98	53	72	72	59	58	372	336	314
Diarrhœa,	174	173	163	141	151	149	123	121	107	129	141	156	137	142	143	808	629	719
Cholera infantum,	829	1 603	1,068	859	992	1 173	959	700	894	891	902	871	873	775	971	5 351	4 547	4 397
Cholera morbus,	53	111	67	51	47	35	43	33	27	73	48	61	29	31	44	309	211	216
Malarial fevers,	59	55	30	51	43	47	40	46	39	49	92	114	112	67	66	237	221	451
Rheumatism,	40	31	45	37	53	53	37	49	34	40	57	50	54	44	60	206	213	235
Cerebro-spinal meningitis,	44	125	238	89	83	85	56	90	62	78	90	51	50	124	87	579	271	402
Other miasmatic diseases,	40	54	77	57	122	109	74	67	106	159	117	102	176	159	166	350	514	720
Enteric diseases,	20	24	33	40	24	34	43	31	37	24	48	33	46	54	39	141	172	220
Dietic diseases,	41	90	57	52	78	87	51	44	42	81	85	138	101	100	93	321	338	518
Parasitic diseases,	0	10	11	10	16	18	0	15	15	9	0	0	0	1	0	47	57	1

TABLE B.—*Deaths from the several diarrhœal diseases and malarial fevers with their ratios per 10,000 inhabitants, during the three periods 1871–1875, 1876–1880, 1881–1885, and totals:*

				RATIO TO 10 000 INHABITANTS.		
YEARS,	1871-1875.	1876-1880.	1881-1885.	1871-1875.	1876 1880.	1881-1885.
Typhoid fever,	1 880	2 559	3 150	5.17	6 39	6.96
Malarial fevers,	237	221	451	.65	.54	.99
Diarrhœa,	808	629	719	2.22	1 54	1.58
Dysentery,	372	336	314	1.02	.90	.69
Cholera morbus,	309	211	216	.85	.51	.47
Cholera infantum,	5,351	4,547	4,397	14 74	11.12	9 68
Enteritis,	1 686	1 951	2 831	4 64	4 80	6.25
Totals,	10 643	10 484	12,078	29.29	25 80	26 62

XXV. Influence of Diet on Health.

By ALFRED K. HILLS, M. D., *of New York City.*

The first duty of the physician to the public being the prevention of disease, there can be no more important subject for our consideration in this connection, than the "influence of diet upon health;" and none can more fully appreciate this factor than the physician who is constantly studying the causes of disease and their probable prevention.

It is universally admitted that the great majority of non-contagious diseases are due to mal-nutrition; and this is largely occasioned primarily by errors in diet which would be preventable through a knowledge of the relative values of foods as nutrients, and of their requirements for digestion.

The question which I desire to bring before this honorable body for discussion at the present juncture is, *How shall the public be instructed as to "the influence of diet on health?"*

We may answer this query in several ways, and perhaps no single method may be sufficient for the purpose, but the combination of all may accomplish considerable!

The *first* method should be commenced in the home, at the very cradle, but this has many drawbacks, chief among which is ignorance on the part of parents; and here under existing circumstances, the office of the physician comes into view, and leads us to the second plan, which will be entirely dependent upon the physician, and involves time and patience as well as knowledge on his part.

Much can be accomplished on the part of the physician, as we know from personal experience; but neither of these methods would speedily bring that benefit to the great public to which we aim, and thus we

are introduced to the *third* and more important suggestion, viz: That the subject be made a special study in our educational institutions—even to the kindergarten—graded to suit the age of the pupil, and so complete that when a scholar graduates from school, nitrogen will be known from carbon, their relations to each other will be understood, their offices in the human organism will be appreciated, and their association as foods be as thoroughly familiar as the language which they have been taught to speak! The young and impressible mind is ever ready to grasp an idea strikingly presented and forcibly illustrated, especially when it is shown to have a bearing upon health and happiness. Well do we remember an instance in which a man admirably adapted to such work, spoke words to a class of children which never will be forgotten; and they dealt only with the most common habits and duties of every-day life, in a most simple manner, which could be understood by all.

We are well aware that there are some difficulties in the way of our proposition, but they seem to us surmountable; and should the subject meet with sufficient favor at your hands for you to appoint a committee to consider it, we have reason to think that a practical solution would be reached.

Doubtless in the beginning the subject could be interwoven with the text of existing school-books; and in the higher departments, where physiology and hygiene are taught, even to a most limited extent, additions could be made to these text-books, and the subject made interesting and as compulsory for graduation as other less important branches.

We are quite aware of the indifference, ignorance and carelessness which prevails, even in the medical profession, as to the "influence of diet on health," not alone as regards their own individual conditions, but also as to that of their patients; and is to be wondered at that the great public which is not supposed to know much of the "influence of diet on health," should remain in its ignorance, particularly when the medical adviser ignores the subject entirely as one with which he has nothing to do?

Medical colleges of course are expected to provide education upon so vital a subject, and graduates should be required to undergo thorough examination in it.

We regret to be compelled to admit that hygiene holds a most insignificant position in the curriculum of many medical colleges, and if students are examined at all, it is in the most superficial manner, thereby impressing them with the idea of its insignificance.

This could be remedied, in a degree at least, if the colleges themselves could be made to feel their position regarding it; and it is such bodies as the one which I have the honor now to address, which can have the most influence in bringing about this desideratum. The "practice of medicine," as it is termed, or as we prefer to put it—*the*

office of the physician—certainly demands something more than the mere prescribing of drugs. The physician should be capable of advising his confiding patients respecting all matters bearing upon physical conditions, as well as many which may be termed mental in their nature; but few are competent by education or otherwise to attempt it. We think that a system of training in the ordinary affairs of life is greatly to be desired, and that our institutions of learning could organize a department which would be practical and useful, by teaching people *how to live;* and the course should be insisted upon, at least with those who would enter the profession of medicine. Then might we expect the public to entertain a higher appreciation of the "influence of diet on health," and all allied subjects as well; then would the public health begin to feel a subtle influence which would be most pervading, and which would in time work a wonderful change in our mortality tables, as well as in the happiness of the people.

Ignorance upon the subject of which we are speaking tends, as is the case always under such circumstances, to partial views; and hence we have sects in diet,—as in other relations in life—such as the "vegetarian" and other hobbyists. The great tendency of man is to find a hobby and ride it, oftentimes to death, and the sooner this goal is reached perhaps the better. It is to be regretted that educated men sometimes lose balance and urge, for instance, upon all alike an exclusively nitrogenous diet in health,—for example the meat diet, or a single meal in twenty-four hours, or eating at too frequent intervals, and a host of other extreme measures, which may be excellent in individual cases of disease, but which may have a most pernicious "influence on health" when adopted by such as are in normal condition.

Physiology teaches us and experience proves that a mixed diet is the best calculated to maintain the body in health; and it has been demonstrated that man under ordinary pressure requires nutrition in the proportion of two pounds of bread (made from ordinary white wheat flour), three-quarters of a pound of meat, with one or two ounces of butter in twenty-four hours.

While too much nitrogenous food leads to an excessive amount of urea and uric acid, it is also a well-known fact that animal life cannot be long preserved on an exclusive diet of fat and starches, as the tissues would soon become worn and wasted, and death from inanition would be the result.

There is a mistaken impression in the public mind as to the sources of sugars and their effects upon the human organism. The fact that there are different varieties of sugar, and that they differ widely in respect to digestibility, is either unknown or entirely lost sight of! Sugar—although not entering into the composition of the tissues—appears to play an important part in the production of fat and the development of animal heat; and the fact that *all starch is changed into a low form of sugar*, which is easy of digestion, and upon which

we should depend chiefly for our carbo-hydrates, should be constantly urged upon the public ear! Cane sugar which is agreeable to the taste of so many, and is so enticing in its sweetness, behaves as a foreign body in the intestinal canal, until it has been converted into glucose; but this conversion is principally intestinal, the gastric juices producing little effect in this direction. It is evident that the task of digesting cane sugar is not an easy one for the organs involved, and we firmly believe that the "influence on health" of cane sugar is under-estimated, and that the indiscriminate use of it in large quantities, as it so commonly is, is a source of no inconsiderable injury. The substitution of glucose for cane sugar, now we are told becoming quite universal for many purposes, is to be regarded we think as a benefit rather than otherwise.

It should be generally known that one of the most important agencies in the digestion and assimilation of food is *water*, and that seventy-five per cent. of the human body is composed of water, and that four and one-half pounds is daily thrown off by the healthy body, and that a diet largely nitrogenous will tax the system severely, unless a considerable quantity of water be taken for the purpose of getting rid of the waste. It is estimated that a full-grown male adult requires fifty-two fluid ounces of water daily. An organized structure will not perform its function without its due proportion of this agent. The evils of over preponderance of fluid in the system should be guarded against in the interest of the solid elements, although the dangers from this source are far less than from too little fluid.

It is cruel to neglect to provide children with cold water to drink at frequent intervals, particularly in hot weather, no matter how they are being fed. If the thirst is allayed by this natural diluent, the child may refuse food which is only being taken to relieve the parched mouth, and is not demanded and will not be tolerated as nutrition.

The public must be taught that digestion is a process of solution by hydration; that to convert starch into sugar a molecule of water must be added under the action of a ferment, and that a peptone is produced by a similar process.

It may be truthfully said that the majority care little what they eat, so long as the appetite be satisfied; but they do care to be healthy, and above all that their children should grow up strong.

The multitude will ultimately be attracted by the gain which is to be obtained from good food, rather than the enjoyment which is to be expected in taking it; but they will not appreciate the subject fully until made to *know* that health and strength depend upon diet, that appetite often is subservient to cookery, and that the stomach should not be crowded with pabulum which has reached there through an excessive and unnatural tickling of the palate. Then shall we get rid of excess in condiments, of the dessert, which is an abomination to

our age; and people will learn to eat fruit in its natural state, without the addition of cane sugar.

We feel that the great majority are underfed because of the lack of knowledge of the "influence of diet on health!"

Some are starving on an excessive quantity of improperly selected foods as to quality, while others are suffering from a mistaken notion as to the needed supply.

It is a pleasure to note the constant advance which is being made in the preparation of foods suited to infants, and it is certainly encouraging dietetically to know that mother's milk can be imitated so successfully.

It is also an important fact dietetically, that predigested foods can be produced which are both perfect nutrients and quite palatable as well. These peptones fill an important place in the dietary, even of the healthy, for at times one in health really requires food which shall not tax the powers of digestion; as for instance when one has to undergo severe mental or physical strain, or when one is too tired from any cause to expect digestion to be normally performed. We have used these articles in the place of wine or other alcoholic stimulant, on many occasions with great satisfaction, and they may be taken at bedtime with great benefit as well as with impunity. We look upon them as excellent promoters of the "temperance cause," as well as of the public health in general!

It has been asserted upon eminent authority that the human race is undergoing a great change, a leading manifestation of which is the growing intolerance of alcohol; and we hope it may be true, for wine-bibbing has an important bearing upon health and in many circles is a part of the diet. We do not under-estimate the value of alcohol in its various combinations, both as a medicine and under certain circumstances as a substitute for food; but it should be intelligently prescribed, in accordance with reliable indications, and not be allowed to affect the "influence of diet on health" by reducing the quantity of food required. A person in perfect health doubtless needs no alcohol, and consequently this stimulant should not be resorted to as a beverage, but rather should be kept in reserve for an emergency, when it will prove equal to the task. In a state of health alcohol is liable to interfere with the appetite and with digestion, and it is only in this connection that we propose to consider it for present purposes. The circumstances which have gained for this agent its position in our dietary tables are well known, and belong to the domain of therapeutics.

We have found that the various combinations in which alcohol is found associated require careful study and individualization, and we cannot agree with the inference of some that it is the *water* and not the alcohol and other ingredients of the admixture which is alone to be credited with the power of sustaining life, or of giving that impetus

which nature requires to enable her to stem the tide of disease and to advance in the direction of recovery. It is a well-known fact that distilled alcoholic liquors produce influences upon the sensorium and upon the process of digestion quite at variance with those articles which are the product of fermentation, and this fact should not be lost sight of in our study.

While brandy, whisky, and the like excite belligerency and irritate the mucous membrane of the stomach at the expense of nutrition in those who imbibe them too freely, it is equally well known that wines, ales, &c., even when taken in sufficient excess to produce inebriation excite an entirely different condition of the sensual faculties as well as having an entirely different effect upon the gastric function.

The poor wretches given up to absinthe-drinking suffer from a peculiar train of nervous symptoms, the most prominent of which is epilepsy of a remarkably severe character. The last moments of the the absinthe-drinker are truly horrible. Absinthe, besides alcohol, contains several ethereal oils, of which the most important is the oil of wormwood. It has been often observed that the use of this beverage results in disorders widely differing from those caused by alcohol alone; and the oil of wormwood has produced in animals, tetanic convulsions similar to the epileptiform convulsions which affect absinthe-drinkers.

We regret to say that this habit is taking a strong hold in this country, especially with women; and its influence upon health by decreasing the appetite for good healthful food, is of great importance and should not be overlooked in the consideration of our subject.

Physiological experiments indicate the necessity for a more careful study of alcohol and its relations to the gastric function. It has been found that the digestion was not only retarded by its introduction into the stomach of a dog, but that the secretion of gastric juice was entirely suspended for a time by its use in strong doses. This condition was probably induced by its physical properties as an irritant-corrosive, rather than by any other influence.

These facts should teach us that the introduction of any toxic agent into the stomach in quantities sufficient to paralyze their natural functions, is entirely out of the question from the standpoint of scientific practice. Alcohol when taken upon an empty stomach, first increases the appetite; but if the indulgence be continued, it gives rise to indigestion and entire loss of both desire and relish for food, together with gastric irritation and intense thirst, although in some instances not a drop of water can be retained.

Because of the profound influence of alcohol upon the functions of digestion and assimilation, it is incumbent upon us to trace out its workings in this all important sphere with especial care. The pathological lesions dependent upon a long-continued use of alcohol are too well known to require consideration for present purposes.

We feel that our subject is too immense and pervading, to do it justice in the few short sentences which we have aggregated, but the purpose of our essay is only to offer suggestions which may bring out discussion which I trust will follow, to the end that the "influence of diet on health" may be more fully appreciated.

XXVI. House and Yard Ventilation.

By W. C. VAN BIBBER, M. D., *of Baltimore, Maryland.*

Much has been written and published about house ventilation for both city and country dwellings, yet comparatively little has been said about the ventilation of back yards, and premises, and alleys.

If ventilation means "to open or expose to the free passage of the air or wind—to cause air to pass through"—then it is plain when it is intended to accomplish a proper ventilation for the purposes of health, the foul or damaged air in a house must be replaced by pure air. In the cities and towns throughout our country, as things now exist, it is a problem where to obtain this pure and fresh air. The yards, premises and back alleys around the houses, are not now attended to as they should be to effect this purpose.

I am personally quite familiar with this subject in many of the cities, towns and villages in the States of Pennsylvania, Maryland, Virginia, New York, Canada, Ohio, Louisiana and Mississippi. The yards attached to houses, are, for the most part, from fifty to one hundred and fifty feet deep, more or less, and are generally surrounded with decaying board fences, from six to eight feet high; and these yards have been, as a rule, the receptacles for all thrown-away matters of a family for a long time. The exhalations from such yards are bad, and if an atmosphere, laden with these impure emanations, should be introduced into a cleanly house, the effect must be injurious. It is generally believed that the filth-pestilences—those diseases caused by micro organisms—are brought about in this way. Thus it will readily be seen that whilst making provisions for ventilating the houses, if the yards, premises and alleys are neglected, matters may be made worse, and thus ventilation be deprived of all its benefits.

In a report made to the Maryland State Board of Health, in 1878, I said, "Encamped upon an eminence in the State of Mississippi, I once beheld a beautiful village, situated in a plain, upon the south bank of a gracefully sweeping bayou. Cluster roses and creeping plants and flowers completely covered the roofs of the houses, so that, in the early dawn, it looked like a fairy city of enchantment. Who would have supposed it was so fair without, and yet so foul within? Its high board-screened, undrained, level and water soaked yards, were filled with rubbish, dirt, and things offensive and useless, which sheer care-

lessness had allowed to accumulate, and a filth-pestilence was even then rapidly filling its cemetery." This town was Port Gibson, the capital of Claibourne county, Miss.; and I have seen many such towns, similarly built and fashioned, in all States which have been mentioned. Indeed, it is well known that cities and towns having such yards as described, are not only found in all the other states in our union, but also in every other country on the earth. The older the towns and the warmer the climates, the worse these nuisances.

It may not be polite to criticise our hosts, and those who entertain us so agreeably, but yet if done in the way of public spirit it may be excusable and even condsidered a kindness. Go into the back rooms of many of the houses in this city on a sultry summer's day, and then tell me where the pure air required for a proper ventilation can be found.

Obstructions to the free circulation of the air, in the form of houses, large and small, constitute cities; and, of course, must necessarily exist wherever a city is built. But the high, tightly closed yard fences, which effectually obstruct surface ventilation, form alleys, and hide such an abundance of filth, may soon, I trust, be done away with forever. The curb-stone, a flower-bed, an iron railing, or a slatted wooden fence, may be most advantageously substituted for them. Beauty, cleanliness, healthfulness and security to property, will be increased by the removal of these close-fitting yard fences.

This is certainly a most important matter, and a needed improvement; because the many small yards, thus fenced off, make an immense aggregate surface. If the curbstone can be made, by statute law, an equal protection to the lock upon a high board fence, being lighter and hence more secure, as well as more cleanly and beautiful than the old fashion of which we now complain, then the open yard system will prevail, and soon be brought into popular favor. Already in this city, Philadelphia, several pub'ic-spirited and distinguished citizens, notably Mr. Joseph Harrison, have erected elegant and commanding rows of houses and adorned the yards in the rear with beautiful gardens without the obstructing partitions. Two instances to illustrate this improvement may also be cited from the city where I live (Baltimore). Upon the grounds where the Johns Hopkins University now stands, there were formerly many houses, and all the yards were enclosed with the conventional eight-foot-boarding. The enlightened president and trustees of this advanced institution, among the many other benefits they have conferred, have removed these fences and substituted curbing and flower-beds. The secretary of the Maryland Board of Health, Dr. Chancellor, has made a similar improvement for the yard of his dwelling.

Many other examples could be given from other cities and towns north and west, or throughout the country generally. The object of

this paper is to call the attention of this convention to the importance of these examples, and to encourage the enactment of statutes which will foster and compel such an improvement. If the citizens of Philadelphia, Harrisburg, Lancaster, York, Pittsburgh, and the hundreds of smaller towns throughout the Keystone State, will seriously and industriously combine to alter this old-fashioned nuisance in the building of their towns, I can think of *no one thing* which would be likely to add more to the general healthfulness and pleasure and domestic pride within their State. Besides removing thousands of ugly obstructions to the wind, blowing over a naturally healthy soil, the children of future family generations would hereafter vie with each other, and with their neighbors, in planting a flower or a tree to adorn those premises into which their parents, by pulling down these fences, had already allowed the winds to enter and the light to shine.

XXVII.—Forced Ventilation vs. Natural Ventilation (or Ventilation by Heat.)

By RUSSEL THAYER, C. E., *of Philadelphia.*

Air to be perfectly healthful must be pure.

Air is contaminated by many causes, most of which originate from man himself and his surroundings.

As man inhales the air that envelopes him, to keep the man supplied with pure air, you must move the man or move the air.

To move either requires an expenditure of force and it therefore depends upon the relative economy in expenditure, as to which costs less to move.

But the man may from necessity be unable to be moved; then the problem is narrowed down to the consideration of the best means for moving the air.

Air unconfined needs no artificial impulse, but air that we breathe is far more often confined. Hence again our question is narrowed to the consideration of how to move confined air. Confined air can be moved by heat acting expansively and directly upon the air as when we use a fire-place or heated flue. We can apply the heat to water, and carry the steam to the vent flue where by the condensation the heat is applied to the air column to be lifted.

In either case we are said to ventilate by heat.

If however, we go a step farther and apply the steam to move a fan which in turn moves the air we are ventilating by mechanical means.

In any case we employ power, and consume fuel to obtain the power, and it is finally narrowed to a discussion of fuel consumption and power application in the consideration of the question, which

tends to produce the most satisfactory results in ventilation, a fire or a fan.

The friends of heat ventilation and the enemies of all ventilation arraign fan systems on three charges, viz:

First. As costing more.

Second. As being more complicated.

Third. As requiring more skilled attention.

The chief claim made by advocates of fans "that they do or can be made do better work" is tacitly allowed. And this shows the inconsistency of the general public, for in arguing a question before an association of this character it certainly is hardly to be expected that the question of *cost* should be given so much prominence. But in defence the writer appeals to your own experience. Is it not very often the case that the first question in regard to any sanitary appliance is, "How much does it cost?" This is no exception and in attempting to place before you the relative merits of fire and fan ventilation it is impossible in any spirit of fairness to pass by unnoticed the objection so often urged against fan ventilation, the great cost.

Cost or money outlay can in this instance be considered as first the outlay for the plant, and second, subsequent outlay for maintenance.

A comparison of figures will probably show that the outlay for fan plant is generally, if not always, in excess of that required for fire ventilation. And this may be ascribed to two causes. First, if steam heating is employed, the unwillingness of the contractor to allow proportionately for parts rendered unnecessary by use of fan, and further the retention of fire-places as matters of ornament even when unnecessary. And, second, because the first cost of fan and motor and necessary equipment is considerable. A third reason for this might be found in the fact that heat ventilation is good, bad or indifferent, according as it is cared for or slighted, and that each diminution is attended with a decrease in cost, so a heat ventilating system which as first laid out is quite elaborate is by successive restrictions, omissions or changes reduced almost to a nonentity, yet always retaining its name and full title; while with mechanical ventilation there is a limit to omissions and restrictions, for even if all else be removed you must have a fan and motor to make your system "mechanical."

Comparisons therefore, are often unfairly made between inefficient specimens of heat systems costing little, and well laid out fan systems, always in point of cost to the disadvantage of the latter. Critics are often unjust in their strictures. For example, a system of fan ventilation was recently put in a public building in Chicago at a cost of nearly $30,000, an enormous amount the critics claim.

Bearing in mind that owing to the absence of any adequate provision of flues, two-thirds of the outlay was for galvanized iron pipe to supply these deficiencies, the remainder is no very great sum considering the duty required, viz: 36,000,000 cubic feet per hour.

In another case a ventilating company offered to ventilate a large office building for $6,000, when the plans were first drawn. The same company, after the completion of the building, has been called upon to do the work, but at a cost to the owners of $15,000, and that with several floors omitted.

The question of first cost is easily and economically settled provided experts have access to the plans at the beginning, for no system can be cheap that must be placed in an occupied building.

This charge of excessive cost of plant originated at a time when ventilating fans and machinery were crude and the loss of power enormous. People who to-day repeat this forget that ventilating machinery has been keeping pace with all other devices in the march toward perfection. A horse-power to-day will move 15,000 cubic feet of air per minute and with machines utilizing 80 per cent. of the power applied.

The cost of maintenance has been most carefully examined. By tests, for the accuracy of which the writer can vouch, the following results were obtained: The flue system was both horizontal and vertical. The air or escape shaft was 40 feet high and 38 inches diameter. The temperature of external air averaged 18° Fahr. By the use of a fixed quantity of coal a *fan* removed and discharged 875,000 cubic feet of air per minute, a grate fire 425,000 cubic feet, a steam indirect stack 360,000 cubic feet. All modern tests with improved machinery prove that, pound for pound, fuel will do twice the work in moving the air, when used to generate power for use with a fan than when applied directly. The second and third charges, as requiring more skilled attention, because more complicated, can be considered together.

The tendency in modern buildings is to complicate the system of heat ventilation, if used, and to simplify the system of fan ventilation. As buildings have grown into such enormous proportions, the systems of heat ventilation are found to be inadequate to satisfy the demands of an educated public, when applied in their simpler forms. So they have grown by constant additions and modifications, while the latter or fan system, at first regarded with doubt by even its staunchest friends, and therefore hedged about with every safeguard, has been found after experience to require none of these complications, and to-day is better in fact with the fewest possible parts.

As to requirements of skilled service, there can hardly be a question, for with mechanical devices almost, if not quite automatic, and with the greatest simplicity in arrangement and construction, there cannot possibly exist the demand for skilled attention which is so often insisted upon.

But there are other advantages peculiar to mechanical ventilation which can be best shown by comparison.

All systems of so-called natural or heat ventilation depended for their efficiency upon a difference in weights; for as a confined volume

of air is heated, hence rarified, the column becomes lighter than a corresponding column of outside air. Thus the force of gravity is called into action, and the heavier outside air rushes in to displace the lighter warm air. With tall chimneys and intense heat, this difference seldom amounts to the fall of more than a few feet. The suction power therefore is seldom strong and must be carefully nursed in all the modifications of branching flues. Extreme care must be taken in fixing dimensions, proportioning areas, avoiding or providing for bends and turns, lest the distant points where the suction is to be felt are slighted. How easily, with such demands for splendid engineering, is it for inexperienced or incompetent people to make fatal mistakes.

Then again, heat ventilation is not elastic. Designed with reference to certain conditions within and without, a change or modification of any one of the elements disarranges the system. The flue may be too small or too large, too short or not of the proper shape, proportions or location, or not properly connected. The temperature outside will constantly vary and the duty done by the shaft will vary accordingly. Then again, the wind may be strong from the east, west, north or south, and the exposure of each room will effect the volume of discharge. The heat may be insufficient to lift the air column, and the rooms may ventilate into each other. The hot air flues may blow cold as well as hot air, and down draughts be found where up draughts were intended. The air may be heavy and moist and sticky, and the ventilation correspondingly sluggish. With all of these possibilities is it any wonder that in spite of lavish expenditure it is so difficult to find a perfectly ventilated building, ventilated by heat?

If it were possible to correct the rise in outside temperature by extending the flue by some means, by expanding and contracting it as the demand for ventilation increased or diminished, then and not until then would it be possible to arrange a perfect system of heat ventilation.

But how is it with a correctly placed fan? Depending simply upon the power supply, the speed can be changed and by it the volume taken from or given to any room, however distant, can be varied. A variation of temperature or an increase of moisture cannot affect it, and at the same time the ventilation of the building is entirely independent of the movements in the extraneous atmosphere. There is nothing in the condition of the elements to be feared. With the same care as to details the fan system is immeasurably superior, because more positive and reliable. If details are neglected the heat system fails altogether, while the fan will still do work. What would the ordinary heat system do in a pipe that made nine (9) distinct separate bends in a length of sixteen (16) feet? And yet three rooms to-day are ventilated by such a pipe from a fan, with a variation of less than one foot a second from their more favored neighbors.

It is difficult or useless to ask of any system of ventilation perfect

work, without providing suitable access. The architect, driven well nigh to desperation by the demands of the style or use of the building, or worse still the whims of the owner, and not correctly informed as to the facts, rejects mechanical and turns to heat ventilation as the only system possible "in this case." Any draughtsman can lay out series of flues in a building plan for heat ventilation, but few can make them work. No architect who has consulted an expert worthy of the name, but has found that the system of mechanical ventilation could be varied to suit requirements, and if mistakes were made in size, if unlooked for changes were demanded at the last moment, the fan could still turn a little faster, work a little harder, and do a little more than at first asked or expected. The net result may not be what it should be, but there will still be *results*.

It cannot be denied that there are some few places where heat ventilation may be more economical and the only available means to be used. The line, however, of demarcation can be easily drawn, for when by reason of size or peculiar arrangement, *any complication* enters into the problem, then the economy of heat ventilation disappears.

There has been within the past few years a rapid and radical change in public opinion as to the necessity for ventilation and the best means of obtaining it. This has not been accomplished without great effort nor without much wild theorizing. And while to-day there is much to discover experimentally, it can be safely claimed that the entire theoretical field has been well investigated. In this, as in many other departments, where theory and experiment go hand in hand, experiment has lagged, while theory has run wild. We have rested content with the experimental research of others. We have in some cases taken another's works and built our theories upon them, as facts, only to find at last that the so called facts were veriest fancies.

Atmospheric conditions, methods of life, and plans of construction differ essentially in some important particulars in this country from what we find abroad in many places, and it is more wise to carefully weigh and consider these important elements in dealing with the intricacies of the problem of ventilation, as applied in our own country, than to rely too largely upon experiments and data found in foreign treatises having reference to the subject under consideration.

That we need pure air, is an axiom in the minds of most people. But how much do we need? How seldom is the question asked by the owner of a building? Is it not more often the case that the inquiry is made, how little can we live upon? and annoyed by the estimate of cost, he looks longingly back to the golden period of the past, when, as they say, there was no ventilation and no experts and no sanitation.

In the ventilation of our buildings let us avail ourselves of the power which is perfected for our service. In this question, as in

others of a like scientific nature, the mind of man has been able after careful thought and investigation to control matter. Prime motors can now be obtained suitable for this purpose of great variety, efficiency and economy of operation. Fans are made which grasp the air with which they come in contact and drive it with perfect reliability to the points where it is required. The mechanics of the problem are simplified and understood, and by using *forced means* of ventilation either on the "vacuum system," or "plenum-vacuum" combined, we are assured of an absolute certainty of results, which in my judgment and experience cannot be obtained by any other means.

XXVIII. "The Majesty of Law in Sanitation"

By J. Andrews Harris, D. D.,
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This paper is not unnaturally written from a clergyman's point of view. It begins with the postulate that there is a God. It assumes nature to be the outcome of God, and to be governed by His laws. It understands this convention to be the means of increasing popular knowledge on important subjects, not only by the presentation of original study and thought, but also by a popular presentation of what others have thought and said,—thoughts recorded in documents not perhaps generally read and yet which ought to be widely known, and it seeks rather to collate than to originate.

There a question recorded in a wonderful book written long ago,—the book of Job,—and one to which a negative answer must always be given. The question is this: "Canst thou by searching find out God? Canst thou find out the Almighty unto perfection?" The answer is "No." And yet the men of the present generation, inheri tors of the gropings of past ages, know more about God than the elders did. They have learned this much, if they have learned nothing more; that he is the God of *law*, not of caprice; that, from the movement of myriad suns, each with its planetary system about a central point in infinite space, to the growth and propagation of microscopic, "bacteria," all is regulated by *law*, inexorable in its functions, faultless in its operation. God never breaks his laws; he never permits them to be violated with impunity. They operate in the material universe with inevitable accuracy; with the same accuracy they work in the spiritual universe. God never changes his mind,—let us thank God for that; it is the one element of stability amid what, in our ignorance, seems often to be so fluctuating. No grander statement of the fact was ever made than that which describes

him as "the Father of light, with whom is no variableness, neither shadow of turning."

Men have been a long time finding out this truth, even with nature spread out before them, even with "revelation" in their hands; and no wonder, for nature is vast, and revelation has been but a series of slow progresses, and law is complex. Its complexity has often obscured, does often obscure the secret of its working. But even the apparent exceptions, when men get to understand them, only establish the majesty of law. Science,—by which is meant *knowledge of law based upon observation of facts*,—is making this more and more evident. Theology—by which is meant the *rationale of Diety and his relations to man*,—seems not yet to have its feet firmly planted on the rock upon which science stands; but it is approaching that foundation; its feet are upon the outer circle of it; and when it shall have advanced to where science stands, then will be recognized the likeness of twin sisters, and then "shall be brought to pass the saying that is written, 'Mercy and truth are met together, righteousness and peace have kissed each.'" Each understanding the other's language, both bowing reverently before the God of *law;* and their blended voices shall ascended in tuneful harmony, eternal as the ages, to the throne of God in the everlasting refrain, "Great and marvelous are thy works, Lord God Almighty; just and true are thy ways, thou king of saints. Who shall not fear thee, O Lord, and glorify thy name?" Thenceforth will be impossible the saying, "Where a scientist is, there is an atheist; where a theologian is, there is a fool."

Under this view of things a "miracle" will be seen to be, not a *breach* of law through Almighty caprice, but the outcome of a *not understood combination of laws*, or of *an as yet unknown* and *higher law*, by divine power to effect certain purposes. Under this view of things, just as surely as one believes that he cannot "by searching find out God," that he cannot "find out the Almighty unto perfection," so *and therefore* must he believe that he cannot always comprehend or explain the *extent* of his power to effect results by combinations of laws in ways as yet unknown to man, or the extent of his power to effect results by the operation of a law higher than those yet known. Under this view, the question will not be "is a miracle possible?" but "is there evidence that it was actual?" Under this view, if in times of pestilence litanies go up to God for salvation from its terrors, it will be not to supplicate God to break his laws because men have been ignorant of them, or, knowing them, have been fools enough to break them; but it will be to implore him to give a better knowledge of those laws by an enlightenment of the understanding, and to give the courage of humility to reverence and keep them.

For the growth of a single blade of grass is as truly a "miracle," *i. e.*, the operation of laws which evidence the presence of *divine power* as was the giving of sight to the blind or the raising of Lazarus from

the dead. But *all*, the effect of *law*, in the one case proximately understood, and therefore called "natural," in the others absolutely mysterious as yet, and therefore called "super-natural." For, in very truth, the dividing line between "the natural" and "the super-natural" is the line of our ignorance of the law of the latter, and our assumed knowledge of the law of the former. To believe anything else is to undermine any intelligent faith in "the Father of light, with whom there is no variableness, neither shadow of turning," faith that "God is all in all."

As a single illustration of what is meant, take the case of what has been recently accomplished by a "combination" of known laws of forces,—the sending and receiving of messages by telegraph on a train of cars running at full speed. Fifty—certainly one hundred—years ago, this would have been considered a "miracle" in every sense of the term, *incomprehensible*, *inexplicable*, and in the most advanced scientific judgment *impossible*. Indeed, in some parts of the world it would have subjected him who accomplished it to the faggot and the stake, as being in league with the evil one. It is no less *wonderful now;* but we know that it is the result of the operation of *law*. *Then* it would have been counted "super-natural;" *now*, it belongs to the sphere of the "natural;" although *what* electricity really *is* we know as little as we know *what* the *life* in a growing blade of grass really *is*. There are all grades of misunderstanding the processes of the laws of forces. In the early days of the telegraph, a conscientious and thoughtful lady of Milesian parentage, doing household service in my father's family, once said to me: "Misther John, I don't rightly understand how thim lethers they send by telegraph gets past the poles the wires is on!" To *her* it was as incomprehensible as a "miracle."

And now, as to the application of these thoughts on the majesty of law to the subject of sanitation. "It is a very large and inviting field; but brevity must be studied; and for the sake of brevity and for the sake of appealing to an expert in such matter, let me quote from a book which every one ought to have and read—"Notes on Nursing" by that angel of mercy, Florence Nightingale; and simply with reference to the health of houses.

After enumerating five *essentials* to such health, viz: Pure air, pure water, efficient drainage, cleanliness, and light; and after showing just how and why they are essential, Miss Nightingale says (p. 29, sq.):

"And now, you think these things trifles, or at least exaggerated. But what you 'think' or what I 'think' matters little. Let us see what God thinks of them. God always justifies his ways, while we are thinking, he has been teaching. I have known cases of hospital pyæmia quite as severe in handsome private houses, as in any of the worst hospitals, from the same cause, viz., foul air. Yet nobody

learned the lesson, nobody learned *anything* at all from it. They went on *thinking*,—thinking that the sufferer had scratched his thumb, or that it was singular that 'all the servants' had 'whitlows,' or that something was much about this year; there is always sickness in our house.' This is a favorite mode of thought—leading not to inquire what is the uniform cause of these 'whitlows,' but to stifle all inquiry. In what sense is 'sickness' being 'always there,' a justification of its being 'there' at all?

"I will tell you what was the cause of this hospital pyæmia being in that large private house. It was that the sewer air from an ill-placed sink was carefully conducted into all the rooms by sedulously opening all the doors, and closing all the passage windows. It was that the slops were emptied in the foot-pans; it was that the utensils were never properly rinsed; it was that the chamber crockery was rinsed with dirty water; it was that the beds were never properly shaken, aired, picked to pieces, or changed. It was that the carpets and curtains were always musty; it was that the furniture was always dusty; it was that the papered walls were always saturated with dirt; it was the floors were never cleaned; it was that the uninhabited rooms were never sunned, or cleaned, or aired; it was that the cupboards were always reservoirs of foul air; it was that the windows were always tight shut up at night; it was that no window was ever systematically opened even in the day, or that the right window was not opened. A person gasping for air might open a window for himself. But the servants were not taught to open the windows, but to shut the doors; or they opened the windows upon a dark well between high walls, not upon the area court; or they opened the room doors into the unaired halls and passages by way of airing the rooms." Miss Nightingale goes on to say, "now all this is not fancy, but fact. In that handsome house I have known in one summer three cases of hospital pyæmia, one of phlebitis, two of consumptive cough;—all the *immediate* product of foul air. When, in temperate climates, a house is more unhealthy in summer than in winter, it is a certain sign of something wrong. Yet nobody learns the lesson. Yes, God always justifies his ways. He is teaching while you are not learning. This poor body loses his finger, that one loses his life. And all from the most easily preventible causes."

This is the testimony of an expert. Even those who are not sanitary experts—I mean parish clergymen—have by their experience in pastoral visiting been often led to wish that the attending physician would use his authority not only in administering drugs, but even more in insisting upon cleanliness and proper ventilation. Such a use of his authority would prevent much sickness, would save many lives. Is it too late for the College of Physicians to take this matter in hand?

But the majesty of law asserts itself elsewhere than in the sanitary

condition of private houses. Why is it that children—sometimes teachers—sicken and die from attendance at our public schools? It is positively shocking that such a record as the following should be possible in a city one of whose boasts is its system of public education. The record is taken from the daily papers, and is in a measure official. Names are here suppressed, and localities designated by letters of the alphabet. One statement was to this effect:

"A fever-stricken little boy is tossing upon his bed at No. ———— street; he is ten years old; he may get well, and he may not. Two weeks ago, with many other little mortals in his district, he pondered over his primer in the old A school-house. One afternoon he lost his cheerfulness; his cheeks were flushed, he had a headache, and he has since been in bed. Dr. —— says it is typhoid fever, and it is said it was brought on by the deadly gases from the outhouses of the school, which are sadly in want of attention, that every child is liable to get get sick. * * The cellar of the school, a resident in the vicinity says, is often covered with stagnant water."

Now let me call your attention to the following astounding statement, appended to the above account: "A health officer (name here suppressed) says, *if a complaint is filed with him* he will send an inspector to the premises!" As if the *facts* of the case were not complaint enough! While the school directors and the health officers have been neglecting their duties—probably not understanding the first principles of them—the majesty of law has been asserting itself in consequent sickness and perhaps death. Nor is this an isolated case. From another prominent paper I take the following:

"A medical inspector of the Board of Health has prepared a report giving the result of his inspection of a number of the school houses of this city. For brevity's sake I will summarize:

School house B.—Location so bad and atmosphere of building so defective, that it may be unwise to expend any money in efforts to improve its sanitary condition! And yet the *laws* of health and disease work on remorselessly among the children sent to that school!

School house C.—Old; becoming more dilapidated every year.

School house D.—Badly arranged and defectively constructed. Not susceptible of much improvement.

School house E.—*Remains without change as previously reported.* The extremes of light and darkness are exemplified here.

School house F.—Outhouses still too close to the building.

School house G.—No *improvement* noted in condition. Cellar still damp—even quite *wet from an obstructed drain.*

School house H.—No change has been noted; yard still filthy and offensive.

I humbly submit that the above exhibit is simply appalling in its evidence of the incapacity, ignorance and criminality of *some* at least of those who have charge of the public school system of Philadelphia.

But until the national tariff ceases to be an issue in the choice of school directors; until that official position is sought and filled according to some more rational plan than being able to carry a precinct for some political "boss," a long-suffering but lethargic public—which has *some* rights in the matter of public education—must be content to ponder sorrowfully upon the majesty of God's law, which will not swerve from its inexorable processes even to please politicians. The chief *penalty* of the breach of law falls, alas, on *innocent* victims. Those who are taxed to produce this result should take some swift and stern measures with those who are responsible for it.

Much might be said in this connection about the impure and otherwise defective water supply of this great city; about the ill-paved and often filthy streets; about the absolutely defective sewerage system, did time permit. The majesty of law in sanitation *will* in time assert itself in spite of demagogue, "boss," and politician; for, in the words of one of England's greatest divines: "Of law there can be no less acknowledged than that her seat is in the bosom of God, her voice the harmony of the world; all things in heaven and earth do her homage, the very least as feeling her care, and the greatest as not exempted from her power; both angels and men, and creatures of what condition soever, though each in different sort and manner, yet all with uniform consent admiring her as the mother of their peace and joy."—(*Hooker, Eccl. Pol.*, I., § 16.)

XXIX. Filtration of Drinking Water—A Vital Necessity.

By CHARLES F. WINGATE, *Sanitary Engineer.*

The importance of thorough filtration of drinking water is apparent to every thoughtful observer and can hardly be over-estimated. The sources of both public and private supply are so liable to contamination by dangerous impurities that no dependence can be placed upon their purity. Every little while it is discovered that the water supply of some place, previously supposed to be pure and perfectly wholesome, is contaminated by sewage or other filth. Naturally, the people who make these discoveries are amazed and alarmed, yet few persons have any conception of the extent to which pollution in water exists. It may be said to be the rule rather than the exception in all thickly populated and rural sections, and even in towns which have a public water supply, a vast amount of disease is traceable to such sources. In this country the majority of typhoid epidemics have been caused by polluted water. In Massachusetts alone, from specific contamination of drinking water, there occured from 1840 to 1880, 393,000 cases of typhoid fever and 40,000 deaths. The great cholera outbreaks of

history have been accounted for in the same way. In short, a pure water supply as stated by Hypocrate is one of the three essentials to health, second only to purity of air.

The growing consumption of mineral waters has been stimulated by the increasing pollution of the public water supply, but unfortunately these sparkling fluids are often manufactured from water that itself is sadly polluted. Intemperance has undoubtedly been fostered by distrust of drinking water, and the most ardent total abstainer might be tempted to decline the iced decanter of "Schuylkill straight" in favor of some less poisonous decoction. Milk, beer, Apolinaris, all alike are tainted with impurity. The trail of the serpent is over them all.

Physicians of experience ascribe the marked increased in renal diseases in all sections of the country, among persons of all conditions, and of both sexes, as in a great measure due to sediment contained in drinking water, which the kidneys, the filters of the body, cannot eliminate from the system. Hence the clogging and consequent degeneration of those organs.

Owing to the hardness of the water and the mineral matters held in solution in so many springs, preference must be given to the waters of rivers and ponds which are better adapted for domestic use.

Consumers will naturally choose the most abundant and convenient source of supply, and therefore rivers and lakes will have the preference. Nevertheless the very magnitude of these sources of supply will tempt the ignorant and unwise to pour into them their household and individual wastes.

Dr. Charles Smart, in his paper on Water Supply of Cities, read before this convention, very justly declared that chemical tests alone are not conclusive evidence of the wholesomeness of a public water supply, in the face of an excessive mortality from diseases like typhoid fever, which are largely traceable to a polluted drinking water.

Furthermore, to quote the last annual report of the New York State Board of Health:

"It is a thing of common experience that water highly contaminated even with execremental matter may be drunk for a long time with apparent impunity by many people; but that at some unexpected moment, either from an as yet unknown change in the fermentation process or as is often probable, from the introduction of an almost inappreciable quantity of specific infective excreta, an outbreak of typhoid may devastate the community thus supplied."

The distinguished sanitarian, Simon, tells us that the effect of impure water is not always sudden, violent or general. On the contrary, its results are more usually so gradual as to often elude ordinary observation, but is not the less real on that account.

The extent and manner in which a public supply is liable under the the best conditions to be contaminated is aptly illustrated in the case f New York city. In purity, color and wholesomeness, the Croton

ranks second to no other potable water; yet a recent official report by the New York health authorities states that the Croton water shed embraces 239 square miles, and has a population of 20,000 with 1,879 dwellings, besides barns, pig pens, cesspools, cemeteries, slaughter houses and other sources of contamination and with no drainage excepting on the surface.

Yet in comparison to the water supply of many other American cities, the Croton is purity itself. Philadelphia draws its chief supply. from the Schuylkill, a sewer and factory polluted stream. The 300,000 inhabitants of Newark and Jersey City pump into their reservoirs the waters of the Passaic river filled by the sewage of Paterson. Prof. Leeds says: "The river immediately below the town is black with dye stuffs, the fish carried over the great falls are immediately poisoned, and analysis reveals that the water has acquired an enormous percentage of nitrogeneous matter." Boston's supply is threatened, while Chicago, St. Louis, Cincinnati, Providence, Baltimore and a score of other cities are drinking water contaminated in the same way by sewage, factory or surface drainage, or by cesspool seepage into wells. The large majority of rural and village residents depend upon shallow wells dug in porous soil close to leaching cesspools and the cool draught from the "Old Oaken Bucket" too often contains concentrated poison.

The introduction of a public water works almost invariably leads to a diminished death-rate from zymotic disease, and could the purity of the supply be maintained by filtration the health of the community would be permanently benefited.

But as has been shown, the sources of pollution are manifold and increasing. With the increase of population the growth of manufactories, and the crowding of houses in the vicinity of storage reservoirs and their feeders, filtration becomes indispensable.

Again it is becoming more and more recognized that streams receiving sewage are not purified, no matter how ample their volume or how rapid their flow. Chemical tests alone cannot be taken as a proof of purification. The poison of typhoid has been conveyed twenty-five miles by a river and communicated to forty hospital patients who drank its waters. To quote from a high authority (Mass. State Board of Health, 1876): "If sewage contains the germs of disease whatever they may be, no agency at present known, except a sufficiently high temperature will effectually destroy them."

Hence it is desirable as Parry, one of the best English authorities, says, that filtration should be performed wholesale by the public authorities, rather than to leave it to individuals. Thus rich and poor alike are benefited, and it will not be necessary to trust to cheap and worthless appliances left in charge of careless domestics.

Many towns and water companies filter their water by passing it through beds of broken stone, gravel, sand, charcoal or other material.

These are often very extensive and costly, notably those of the London Water Company and at Berlin. The filter beds at Poughkeepsie cost over $75,000 for the plant alone.

The action of a filter is either mechanical or chemical. Solid particles which are too large to pass the pores of the filter are arrested; other particles adhere to the surface of the filtering material, even after they have been wholly dissolved. Furthermore the air contained in the pores of the filtering substance oxidizes the dissolved organic matter and thus destroys it.

It follows that the more extensive the area of filtering material the greater the power of holding impurities by adhesion; while the more frequently and thoroughly it can be cleansed and aërated the more efficient its action.

More or less elaborate arrangements are provided for cleansing public filter beds. But as a rule this is irregularly and carelessly done, and hence, just in proportion to the efficiency of the filtering material does it become clogged. "Inadequate area and infrequent cleansing," says Prof. Nichols, "are the common faults of many so called filters. The most that can be said of the majority of such filters is that they act with greater or less efficiency as strainers, but they do not remove the finer and more dangerous impurities."

Furthermore, as the filter beds are not covered, the exposure of the shallow water to the hot sun in summer, assists the development of vegetable life which causes a disagreeable odor and taste in the water. Doubtless organic putrefaction may be assisted in like manner. In cold weather the filter beds are frozen and cannot be used.

Prof. Ripley Nichols states that sand is the best material yet used practically on a large scale for artificial filtration. Visible suspended particles and an appreciable proportion of organic matter actually in solution may be thus removed. He lays special stress upon the need of abundant area, frequent cleansing and renewal of the filtering material, constant supervision, protection from the sun and prompt distribution of the filtered water to consumers.

Where a water supply is taken from deep wells, basins or collecting galleries which are fed by "ground water," as at Prospect Park, Brooklyn, the supply will go through a process of natural filtration. But the water from such sources is not always potable.

Dr. Smart in his paper of last evening testified to the satisfactory results achieved by natural filtration, in the percolation of the rainfall through sand, gravel and other porous soils. If a public water supply could be subjected to the same process of filtration by passing it through a sufficient mass of material equally good results would follow. In the case of the soil, there are usually intervals between rainfall during which matters caught in its pores are oxidized, otherwise the pores would become clogged and prove a source of evil. This

further illustrates the need of frequent and thorough cleansing of all filters.

With regard to the domestic filters, it is essential that the material employed should not act injuriously upon the water. The mechanism should be simple and the appliances inexpensive; the filter should be easily cleansed or the material renewed; and lastly not only all suspended particles, but also so far as possible all dissolved organic matter should be removed.

The Japanese use a porous sandstone filter hollowed in the shape of an egg, through which the water percolates into a receptacle underneath; the Egyptians resort to a similar device; the Spaniards use a porous earthern pot. But these devices cannot be thoroughly cleansed; some impurities will remain in the pores of the stone. Spongy iron and carferal are open to the same objection. The various forms of filters that are screwed to the faucet have not enough filtering material in them to be of much utility, and they very soon become foul and offensive. Buck says: "There is no material known which can be introduced into the small space of a tap-filter and accomplish any real purification of the water which passes through at the ordinary rate of flow." Complicated closed filters which cannot be cleansed condemn themselves. Parkes, in his "Manual of Practical Hygiene," says: "Filters where the material is cemented up and cannot be removed ought to be abandoned altogether." Filters in which the water comes in contact with metallic surfaces, either iron, lead, tinned iron or zinc are objectionable from their appreciable influence upon the water retained in them for any considerable time. Pure block tin is the least objectionable of any of the metals. The aim of most filters is to remove impurities from the water as rapidly as it escapes from the faucet. Effective filtration cannot be accomplished when the water does not remain long enough in contact with the filtering material to become purified. Slow filtration or purification is therefore best. Of all the filtering materials mentioned, sand and charcoal are the two that accomplish the best results.

The radical objection to most household filters is that, to use Prof. Frankland's words, "The polluting matter removed from the water is stored up in the pores of the filter and in time develops vast numbers of animalcules, which pass out of the filter with the water, rendering the water more impure than it was before filtration. It is, therefore, necessary to remove and purify the material."

These statements demonstrate the vital necessity of filtration. The question next arises, how far does or can filtration purify? To what extent can it be depended upon to guard the public against the dangers from the pollution of a water supply, and is it applicable for use upon a large scale?

After studying the results obtained both abroad and in this country this inquiry can be answered emphatically in the affirmative. But to

be practicable the undertaking must be carried on upon a large scale. By this I mean that the water to be purified must be passed through a body of filtration material of sufficient volume to insure the complete removal of all matters held in suspension, however minute. On this account the numerous patented appliances for domestic filtration, cannot be recommended. They are too small to perform their duty. It is like setting a child to do a man's work.

It is capable of demonstration that the water supply of the largest cities no matter how great its volume, can be effectually and economically filtered. It is simply a question of ways and means. There are to-day in use in many industrial establishments in this country and elsewhere, including paper mills, breweries and others which consume enormous quantities of water (one manufactory alone using 48,000 gallons per hour), filtering appliances, which have borne the test of years of trial, and which are delivering large volumes of filtered water of a purity, transparency and general quality which would astonish the average water drinker in our principal cities and towns.

Private intelligence and enterprise, have here as in other cases achieved results in advance of the public authorities. Necessity has proved the mother of invention.

With such practical demonstrations of the possibility of purification by filtration, a demand should be made upon our water boards to investigate these appliances and to ascertain the possibilities of applying like methods in cities and town and thus improving public health.

XXX. Narcotics and the Appetites which they Produce.

By R. Lowry Sibbet, M. D., *Fellow of the American Academy of Medicine, of Carlisle, Pennsylvania.*

In commerce, in chemistry and in medicine there is a large class of products called poisons. Some are the products of nature; others are the products of art.

In this class of products there is a division or sub-class, which, in our works on materia medica, are recognized as *narcotics.*

In this sub-class there is a small group, very remarkable in this respect, that they produce in persons who persistently use them, what are called *appetites.* To this small group, and to the appetites which they produce, we ask your attention for a few moments. The most important of them are opium, haschish, tobacco and alcohol. There are a few other drugs which are supposed to produce cravings in those who tamper with them, but they are not generally known to the public.

We are not aware that these drugs have ever been classified in this

manner, or considered with respect to the appetites which they produce, though they have often been described in medical and other scientific works. And as their use, or rather their abuse, has very much to do with the health of millions of our fellows, we think that a paper on this subject may be appropriately read in your presence.

We can, of course, only refer very briefly to the products themselves. The first-named, opium, is the inspissated juice of the poppy plant. It is a product of the east, and cannot be cultivated with profit either in Europe or in America, a circumstance which may prevent its general use except as a medicine.

Of opium very little was known until the commencement of the christian era, when it became an article of trade. It deservedly stands first as a medicine, as it certainly stands first as a narcotic. Its effects upon man are well-known. In moderate quantities it diminishes sensibility, and in most cases produces sleep. It is one of the best pain destroyers known to mankind. In large quantities it produces profound stupor and death.

In the east opium is chewed and smoked in immense quantities, and the habit is well nigh incurable. Its victim is soon enslaved. He loses his natural appearance, his desire for food, his flesh, and his ambition. His sufferings, which may continue many years, are said to exceed those of the drunkard. He becomes delirious. The most disgusting, and the most horrible scenes are perpetually before him, depriving him of rest by day and sleep at night.

Haschish or Indian hemp, is also a product of the east. It cannot be cultivated in either Europe or in America, a circumstance which may prevent it also from coming into general use. Herodotus refers to the use of the seeds as a medicine. It is chiefly smoked, though tinctures and beverages are made of it. When in Morocco a few years ago, I found the natives very much addicted to smoking this drug.

The effects of haschish upon man are even more remarkable than those produced by alcohol. They vary as the constitution of the individual varies. Some persons go into delightful reveries; others take to laughing, singing and dancing; whilst others become stupid, morose, treacherous and quarrelsome. "The habitual use of the drug," says Prof. Stille in his Therapeutics, "entails consequences, no less mischievous than those produced by alcohol and opium; the face becomes bloated, the eyes injected, the limbs weak and tremulous, the mind sinks into a state of imbecility, and death by marasmus is the ultimate penalty for the overstrained pleasures it imparts.

We need not detain you with a description of tobacco. It is an American product, though it may be cultivated in all countries. On this account it is likely to come into universal use. It has an immense trade.

Tobacco is both a sedative and a narcotic. Introduced into the stomach it produces vomiting, prostration, insensibility and death.

When chewed or smoked in moderation its effects are generally agreeable, giving rise to a feeling of satisfaction, contentment and resignation. In the long run, however, its victim pays a heavy penalty. Like all of this small group of narcotics, tobacco is a deceiver. Very many persons, after using the drug several years, find it impossible to perform the ordinary work of the day without it. This is especially true of those who commence chewing or smoking in youth; and for this reason, and for others as well, its sale should be restricted. Its effects upon the health of the individual may not be distinctly noticeable until ten or fifteen years have passed around, when symptoms of dyspepsia begin to appear, accompanied, it may be, by irregular action of the heart, angina pectoris, vertigo, paralysis of the lungs, indistinct and double vision, and general nervousness. Two very alarming symptoms are occasionally produced by the drug, namely, a complete loss of consciousness, resembling apoplexy or drunkeness, the individual falling to the ground, and a fear of sudden death, when there are no indications of it. In a very large number of persons the habit interferes with a successful life, not only by imposing a heavy tax, but by producing a noticeable degree of irresolution, despondency and laziness. For tobacco sickness, its best antidote is alcohol, and hence very many chewers take also to drinking.

This brings us to the most noted of these products—alcohol. Unlike opium, haschish and tobacco, it is a product of art. It is not found in the juice of the grape, or in fruits, or in cereals, as many persons suppose. It is a product of fermentation, and without fermentation it has no existence. It comes to us in disguise and thousands of our fellows are captivated by it and slain. It is in wine, beer, ale, porter, whisky and rum as well as in all other fluids that have undergone vinous fermentation, and from these it may be distilled.

Pure alcohol is known only to the chemist. It is a clear fluid, like water, but much lighter, having a rather pleasant odor and an agreeable taste. When ignited it burns with an intense heat, leaving no residuum. It destroys every form of animal life, even when diluted with half water. It is a subtle and dangerous product and it may be manufactured in all countries.

Alcohol is a stimulant as well as a narcotic. Well diluted as it is in wine, beer, ale and whisky, it produces a degree of intoxication well known to us all. Of late its pathological effects upon man have been carefully studied; and they are now much better understood than formerly. Educated men no longer entrench themselves in the ignorance of past centuries and defend the daily use of alcoholic beverages. Chemistry and medicine have thrown light upon the subject; and the injurious effects of such beverages are no longer denied. On this occasion we cannot delay to speak of the poverty, the wretchedness, the crime, the disease, the suffering, and the premature death of thousands and even millions of our fellows—of the time and talent

wasted, the estates squandered, the expenses of courts, prisons and almshouses, and of the demoralization of the people—all of which may be referred to the appetite for this subtle and dangerous product. Who of us has not seen, in his own relationship, the drinker going through all the disgrace and shame of the drunkard's life, falling and rising again, signing a pledge to abstain from all intoxicating drinks and then breaking it, promising his neighbors and his wife, never to drink any more, and then, the next week, or the next month, selling his coat, or his children's shoes, for alcohol? Do you say he is insane? Ah, no! he has not reached that point, though he is approaching it. He has an appetite or thirst and he wishes to allay it. His condition, mark you, is not essentially different from that which is produced by opium, haschish or tobacco, though it is indeed deplorable. Considering the large number of our fellow citizens who are on the drunkard's path—millions no doubt—and the enormous quantities of these drinks sold in our country, under the sanction of law, all of which produce in the drinker this appetite, *this insatiable thirst*, our subject assumes an importance which places it far in advance of all others that now occupy the attention of the American people.

Having thus directed your attention to this small group of remarkable products we come to consider with equal brevity the appetites which they produce. And if we should seem to differ from others, in relation to them, we would say, that it is for this reason that we have introduced the subject, believing that it should be carefully studied. As synonyms of the noun appetite we may have occasion to use the words craving thirst, desire and other equivalent expressions.

That these appetites have an existence there can be no doubt. We have the testimony of many honest but unhappy people on this point. Besides we have the evidence of our senses, there being many persons in every community who are obviously under the power of one or more of them. If we have not seen the opium-eater or the haschish-smoker, we have seen the tobacco-chewer and the alcohol-drinker.

In the further consideration of our subject, we ask your attention to the following propositions:

1. That these appetites or cravings are not the result of an *original* instinct in the race.

2. That they are not dependent upon an *acquired* instinct.

3. That they are the result of impressions made upon the organism of the individual by his own agency.

Let us notice these propositions in the order in which they are given. And first, if these appetites are the result of an original instinct, then has the Creator implanted it in our race. He has given to man an inclination to injure himself, to destroy his happiness and to shorten his life. Moreover the instinct if it exists at all is hereditary, as all instincts are hereditary. It is transmitted through the generative function and is continuous with the existence of the race. In har-

mony with this theory the instinct may be said to show itself in several ways; in some, in the use of opium; in others, in the use of haschish; in others in the use of tobacco; in others in the use of alcohol; and in all persons, wherever the products can be obtained. In other words, that there is a necessity in our constitution, and in our circumstances, for the use of some such narcotic products. This would of course place the responsibility upon the Creator. It is however mere theory; and besides, we do not find that God has proceeded on this plan in other departments of his creation. He has not given to any of his irrational creatures an instinct which leads them to self-destruction. Everywhere we see that self-preservation is the law of their being; and it is not probable, that he would give to man, his noblest work, an inclination to make use of poisonous products to his own injury.

Infants have an instinctive desire for milk and a little tepid water, but for no other fluid; good milk and pure water contain all the elements of nutrition needed at this early period.

The same instinctive desire is observed in all the mammalia. Immediately after birth they exhibit a desire for milk, and without it they die. In a few weeks or months, they incline to drink, in addition, a little water, but no other fluid. When their teeth have become firm, they begin to manifest a desire for other articles of food; but water is their only drink. Some select a purely vegetable diet; others incline to live upon flesh to the exclusion of all vegetable products; whilst others prefer a mixed diet, but in no case does an irrational animal select and use a hurtful and poisonous product.

If we turn to other departments of the animal kingdom we find that birds, fishes, reptiles and insects are all governed by the same law of self-preservation. They instinctively avoid the use of all products which they suspect to be hurtful to them.

But it is proper to notice another fact, which is recognized in science, that instincts are common to all the members of a class or species. What one does, all others of the same species are inclined to do. The food which one animal prefers, all others of the same class prefer. If an ox prefers grass, we infer that cattle everywhere prefer grass. If a lion prefers meat, we conclude that lions everywhere prefer meat, and that they have always been flesh-eating animals. This is instinct uniform and unchangeable in all orders of animated beings.

Man is not an exception to this rule. He was made to be a cosmopolitan—to exercise lordship over the earth. He has consequently an instinctive desire for a great variety of wholesome articles of food. He can even live, for a time, upon innutritious and injurious products, but it is very plain that he has no instinctive preference for them. In all latitudes his choice is a mixed diet. In the tropics he requires a larger amount of vegetable food; in the frigid zones a

larger amount of nitrogenous products. But in the tropics what one class or family prefers, all others prefer. If in the temperate zones, one family prefers a thoroughly mixed diet. What one Esquimaux Indian lives upon, all others live upon. This is also instinct uniform and unvarying.

But all members of the same family in Asia do not use opium. The people of Morocco do not all smoke haschish. Nor do all Europeans and Americans use tobacco and alcoholic drinks though they have many opportunities to do so. Where any of these drugs can be obtained all should have a desire for it. The children of opium-eaters, haschish-smokers, tobacco-chewers, and alcohol-drinkers should have these appetites if they are the result of an *original instinct.*

But there may be a much larger number of persons who maintain, that these appetites, which enslave so large a proportion of our race, are the result of an *acquired instinct.* This brings us to consider our second proposition which is much more in harmony with the modern theory of the gradual development of our race or evolution. But we think it would be very difficult to show how this theory of an acquired instinct for narcotic drugs, could lead to an improved condition of our race. It would surely be a development or evolution in a downward direction. Definitely stated the theory is this, that individuals in the past centuries or ages, tampering with such drugs as opium, haschish, tobacco and alcoholic drinks, acquired an instinct for these drugs which they have transmitted to these descendants through the generative function. It is precisely this theory that we see discussed in the magazine literature of the day, and which we hear repeated in almost every temperence lecture. We may substitute the word apetite for the word instinct with the full consent of these enthusiastic reformers. The son, they say, inherited his drinking appetite from his father or his mother, his grandfather or his grandmother. The instinct they say is in the family; it has come down, it may be from the third, fourth, fifth or tenth generation and it will be transmitted to others. Let us also look at this theory for a moment.

The theory of an original instinct we have disposed of; it places the responsibility upon the Creator; this one places it upon our dead ancestors who cannot speak for themselves. Whether we attempt to discuss the one or the other of these theories we cannot but suspect that they are both delusions. Their inventors evidently regarded themselves without sin; the one class placing the responsibility upon the Creator, the other upon their parents and their grandparents. Brought before a court of justice they would equally say "not guilty."

As to the origin of this theory of an *acquired instinct* we may take for illustration the case of our first parents who are represented as being unwilling to bear the responsibility of their sin. Adam being accused, said: "The woman whom thou gavest to be with me, she gave me of the tree, and I did eat"; And Eve being likewise accused,

said: "The serpent beguiled me, and I did eat" Adam blamed his wife, and Eve blamed the devil. This has been human nature ever since. We are unwilling to make a public confession.

Take another illustration, that of the drinker who may be supposed to soliloquize with himself in the following manner:

"It is true I am a drinker, I have spent my fortune. I have ruined myself, and disgraced my family. My father drank whisky and beer, and my grandfather too. I have inherited the appetite, and I cannot help it. My wife and my friends may say what they please I am not to blame.

This is the reasoning of many drinkers to-day, and strange to say, it is the reasoning of many so-called scientific men. It is the doctrine of heredity applied to the drinker, and in it he finds his consolation. Is soothes his conscience and allays his fears. It is the doctrine of the magazines, the newspapers and temperance lecturers generally. On the same principle, the present opium-eaters, hascbish-smokers and tobacco-chewers have inherited their appetites, and will transmit them to their children. Considering the fact that one-half of mankind are using narcotic drugs, we have indeed a gloomy view of the future of our race. Schoppenhauer has not presented a pessimism, for the future of mankind worse than this.

But let us look at the facts in the case, as far as it is possible. The statistics which are supposed to bear upon the subject, are very meager and very unreliable. Those collected from inebriate asylums, hospitals for the insane, and institutions for feeble-minded children are necessarily delusive. The reason is, that the facts cannot be obtained in these ways. Perhaps those who have lived long enough in a single community to have associated with three generations would have the best opportunities to collect reliable statistics. The history of ten, twenty or forty families for three or four generations carefully written out would be more reliable than any other kind of information that could be collected.

On the supposition that alcoholic intemperance is hereditary, there should be as many intemperate daughters in a family as sons; but this, we know is not true. Again the children of drinkers should seldom if ever remain sober, but this is not true. We have seen all the children remain sober where the father was a drinker. Again the children of sober parents and grandparents should always remain sober, but this also is not true. We have all seen the children of sober parents and grandparents become drinkers. The strongest case, that we can possibly conceive of, is that of the mother using alcoholic drinks during the period of gestation; and yet we have no good reason to believe that such children inherit from their mother an appetite for strong drinks. Indeed we know that they sometimes grow up and remain sober and industrious men and women in spite of their inauspicious surroundings, the truth is that there is no evidence of a

pysiological, pathological or psychological kind, that can be taken as proof, that alcohol produces changes in individuals which appear in their children, much less that of an instinct or an appetite. Nor is there any evidence that opium, haschish, tobacco or medicine, much as they may interfere with the development of a healthy organism *in utero*, produce appetites or cravings in children begotten and reared in such circumstances.

We conclude therefore that this acquired and transmitted instinct exists only in theory—in the imagination of those who are in search of an excuse which shifts the responsibility of wrong doing upon others. God has not left his creatures without the environment of law. He does not allow the poisonous products which they must necessarily eat and drink, in smaller or in larger quantities, to change their instincts or to produce new ones. He may and does allow many members of a species to die. but he protects the species. He does not allow the ignorance of one or of many to destroy his work. If the eating of a poisonous product could change the instincts and appetites of the next generation the greatest confusion would follow. The world would soon be filled with monstrosities. There are *dead lines* which cannot be crossed, and it is these which protect our race, and indeed every species of animals. We are hopeful for the future.

A few words on our last proposition ; namely, that these appetites are the result of impressions made upon the organism of the individual by his own agency. This view of the subject places the responsibility upon the present generation, but chiefly upon the individual himself, who, unwitting, tampers with these products.

In making use of these narcotics for the first time, it may be said, that we do so, in consequence of some supposed virtue in them, as a medicine ; or we may use them out of mere curiosity. The Asiatic or African having a toothache or a pain in any part of his body may use a small quantity of opium which may be given to him by a friend or his medical attendant; or suffering from a sense of fatigue after a day's labor or of worry, he may smoke a small quantity of haschish. In either case he is relieved ; and in similar circumstances repeats the same act. Curiosity in boys and girls may induce them to tamper with these products when there is neither pain nor fatigue, and the effect upon the organism is the same.

We all know how the habit of chewing tobacco is formed in *our country*. It may be for the purpose of arresting a tooth-ache, but this is a rare case. The big boy thinks it manly to display his fine cut tobacco, imitating the young man of fashion ; and the little boy is curious to know how it tastes. A large number of boys acquire the habit clandestinely, before they have reached their tenth year.

The smoking habit is acquired very much in the same way. The son, on his father's knee, looks with wonder at the smoke issuing from his father's pipe or cigarette; and to his innocent inquiries the

fathers say—"Little boys must not smoke," which of course excites still more the curiosity of the child, and very naturally his reply is—"When I get to be a big man, I will smoke." At present there are millions of boys in our country who are training themselves to the use of tobacco.

The alcohol habit in our country comes later in life, for the reason that in most of our States there are laws which prohibit the sale of intoxicating drinks to minors. These drinks have the advantage, or rather the disadvantage, of being pleasant to the taste, very prompt in their action, producing a degree of mental excitement which we call intoxication. The custom of treating friends, so common in our country, is at the bottom of the drink-habit. It implies a social glass, once a week, or it may be, once or twice a day. These are the first steps in the drinker's unhappy career.

Connected with these habits which may be called narcotic, there are appetites which may also be called narcotic. The latter, however, does not always succeed the former. For example the habit of smoking a segar, once a week or once a day, may not beget an appetite. The habit of taking a glass of wine occasionally, or a glass of beer may not produce a thirst for it, but the habit, in either case, to say the least, is a dangerous one.

How much of tampering with any one of these narcotics is necessary to produce an appetite, we cannot tell. In some the appetite lingers for years; in others it is kindled into a flame in a few weeks or even days. What is remarkable is this, that very many persons taken to the use of two of these products and consequently acquire *two appetites*. They are in the daily use of tobacco and alcoholic drinks, and they apparently cannot live without them. In these cases the victim is bound hand and foot. His appetites drive him from pillar to post. But what is still more remarkable we have persons in every community who have acquired a *third appetite*. To the tobacco and alcohol they have added opium. In such cases, the victim is bound by a triple cord, and he becomes of all men the most miserable. His demons torment him day and night.

Much may be said about the cause of these appetites, but we cannot doubt that they are the result of impressions made directly upon the organism of the drinker. By the use of a poisonous drug of any kind, impressions are made, and if the same act is repeated again and again, the impressions are renewed and deepened. Physical changes are produced. These are very visible in the case of the alcohol drinker. In France the wine drinker has a blue nose; in Germany the beer drinker has a bloated and fixed expression of the face; in England and in America the whisky drinker has a florid complexion and blood shot eyes, and in all, who drink to great excess, there is the tender and careful walk—a sure sign of chronic alcoholism. The physician is best acquainted with the changes produced in the organ-

ism of the habitual drinker as shown by autopsies frequently made. In the stomach, the lungs, the liver, the kidney and in the brain these changes are clearly seen and are now well understood.

Why these poisonous products produce appetites and other products do not, we cannot tell. But this is not strange; since we cannot tell why one drug is a purgative, another is an expectorant and another is a tonic. We know the facts and our duty is to act accordingly.

Finally. What course should we pursue as sanitarians, in relation to these products, so remarkable in their effects, so extravagantly used, so destructive to the health and happiness of mankind? If their sale cannot be suppressed should it not be restricted by legislative enactments? Should their use not be limited to useful and necessary purposes? If other poisonous drugs should be labelled, should not these be labelled? Dr. Benjamin W. Richardson, of London, speaking of the evils of intemperance in his Cantor lectures, says "there is no compensation and no human cure." This may be true of the drink-curse under monarchical forms of government, but in a republic like ours, we can have what the majority of the people wish. We have hope for our country.

XXXI. Technics of Animal Vaccination.

By W. L. ZUILL, M. D., D. V. S.,
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GENTLEMEN: Since the discovery of vaccine virus and proof that it gave immunity to small-pox, one great question has vexed the world of medical science.

It has asked how can we obtain an absolutely pure virus, the use of which will not be attended with the danger of inoculating the patient with some specific disease? This danger, while very great in the use of humanized lymph is very much lessened when bovine lymph is substituted.

This question of obtaining pure bovine lymph has reached its highest development in the countries of continental Europe, where the production of this material is under the supervision of the different governments, who have placed it in the hands of qualified veterinarians, thus obtaining the best guarantee possible for its purity.

Does this same qualification hold good in this country? I am sorry to say that it does not.

How many of the hundred so-called vaccine farms are under the guidance of men who are qualified by reason of their training and

education to distinguish the difference between bovine tuberculous and contagious pleuro-pneumonia; or to recognize this latter disease from that of a sporadic character. I assert, gentlemen, that any of you who are willing to take the trouble, will find that a very small proportion of these farms are under scientific guidance of any kind, even the most questionable.

Vaccine, whether it be obtained from the equine or bovine race of animals, possesses the same characteristics and if inoculated into the human system confers immunity from small-pox, or a second vaccine inoculation. It has been considered that the characteristic properties of vaccine was inherent in the liquid.

This is a mistake. It has been demonstrated beyond the question of doubt that the active principle of vaccine is due to the presence of small special bodies, which by every one is now admitted to be infectious, parasitic, vegetable organisms. These microbes, considered as the specific agents of small-pox and vaccine, are small, perfectly spherical micrococci.

Chauveau has undeniably demonstrated that vaccine lymph deprived of these corpuscular elements lose all its physicial characteristics.

While the microbe of vaccine does not differ in its visible characters from the small-pox microbe, I do not desire to be understood as saying that vaccine is small-pox attenuated by its passage through the body of the horse or cow. Kelbs mentions as a characteristic which is more or less common to the microbe of vaccine as to those of small-pox, the disposition to form groups of four, and has therefore given them the name *micrococcus quadrigeminus.*

For nearly one hundred years the desire to determine the question, whether the vaccine which we emp'oy to protect ourselves from small-pox, came in the first place from the horse or cow, has given rise to the most animated discussion in the medical world.

Jenner in his own work, published in London in 1798, entitled "An inquiry into the cause and effects of variola vaccina," admits that vaccine was originally derived from the horse, recognizing that certain persons, employed to care for milch cattle, were not susceptible to the small-pox virus, with which he inoculated them, and that they owed this immunity to a disease which they had contracted from the udders of the animals which they were in the habit of milking, but at this point he has been obliged to admit that these cattle had taken the disease from horses with which they were directly or indirectly in contact.

This disease of the horse is spoken of by English writers of veterinary literature, as grease; this misapplied cognomen, is likely to lead one astray and to attract our attention from the true constitutional disease termed by M. Bouley horse-pox, to that purely local one called, as I have said by English writers—grease.

Cow-pox may be produced in the cow by inoculating with horse-pox, with natural or artificial cow-pox, or by human vaccine. Upon this property depends the practice known as *animal vaccination.*

The vesicle of vaccination in the horse presents different characters from those which are found in the cow or in man. In this animal they present a conical appearance, instead of being umbilicated, as is found in the last two cases. The secretion of the vesicle is also different in the horse; that from the entire vesicle is effective, while in the cow and man, that from the center of the vesicle only, presents any activity. Let us put a few questions to ourselves and ask what this special contagion is.

Is this contagion the same for man as for the horse or cow, or are there different contagions for each of these.

The solution of these questions depend upon the similarity of the germs of small-pox and of vaccina.

They have for more than half a century been the subject of the most interesting discussions and to-day they may be said to be altogether unchanged and undecided.

It remains for modern scientists to elucidate the facts from these questions.

THE TECHNICS OF ANIMAL VACCINATION.

Up to the present time vaccination termed animal has been resorted to only in the bovine species. I prefer to use for this purpose small animals varying from six to eighteen months of age, although an advanced age is no more serious objection than what would naturally follow from an increase in size. These calves should weigh from two to five hundred pounds and be in good health.

It is seldom that I can obtain animals that are fit for immediate vaccination. As a rule they come to us in a very unthrifty condition. They have been wintered in the barn yard, often without even a shed for shelter, their food which at the best has been corn stalks, has left them in such condition that unless much care is exercised in the first ten or fourteen days, the change of food will be sufficient to bring on an attack of diarrhœa.

Notwithstanding the great care exercised in the change of food of these animals, it is by no means uncommon to see them suffer from slight attacks of this disease.

The first thing necessary after the animal has reached our hands, is to rid its hide of the lice and other vermin, which infest it. This is absolutely essential for obvious reasons. While the animal is running in the field or yard, it appears to suffer little or no inconvenience from these insects, which are benumbed with cold, but immediately they are put into a warm stable they will begin to itch, and consequently rub, bite and scratch themselves. Their temperature will go up to

103 or more, the hair will begin to fall, and in a short time they are sorry looking objects.

To carry out this plan two or three baths of sheep-dip is all that is needed. This, with a week or ten days careful feeding is all that is necessary to bring the animal into condition to be vaccinated.

Color is a question of importance in the selection of animals to be vaccinated, a red and white coat indicate a soft skin; one that is free from black pigmentation is an advantage in our observation of the different stages of the eruptive fever.

When the animal is in proper condition, she is brought into the operating room, where she undergoes a most rigid examination. There must not be any diarrhœa or digestive derangement of any kind, neither must there be any kind of bruise, wound or abrasion, broken horns or hoofs of recent date, as complications of this kind will prevent the take of the vaccination.

Animals upon which are found neoplasms of any kind are also rejected. Elevation of temperature, increased respiration and pulse, with other kinds of acute disease are carefully looked for and as carefully rejected when found. An exhaustive and thorough examination is made to determine the presence of lung lesions and the slightest indication of their presence is sufficient to prohibit the utilization of that animal for the propagation of vaccine lymph.

The animals which are to be used for vaccinating are confined in a large roomy stable, seventy feet long, about forty wide, about ten feet high in the walls, and twenty to the centre of the roof. A number of very large windows furnish light to this building; ventilation and drainage is as perfect as it can be made.

In the winter, the room is kept at the proper temperature by means of a steam-heating apparatus, the walls of this stable are finished in hard yellow pine and oil, while the roof which forms the ceiling is whitewashed.

By this arrangement you will perceive that we have a cattle stable which is almost perfect in its details.

Feeding is carried out in as precise and accurate a manner as are all the other details.

The food consists of bran, ground corn, oats and cut hay, supplied in liberal quantities.

Straw for bedding purposes is used quite freely, a bed twelve to fourteen inches thick is kept under the animals all the time. These animals are carefully groomed twice every day and as much pains is taken with their coats, as if they were race horses. When it is desired to vaccinate an animal, she is led to the operating room and there placed upon an upholstered table upon their backs, their legs upward, each of which after being protected by a pad of thick felt, is securely fastened to a post in the frame of the table. While in this position the hair is removed from the inside of the thighs and the belly as far

forward as the umbilicus. This hair is first removed with the scissors and soaped and shaved, perfectly clean. Upon this shaved surface are afterwards placed from fifty to seventy, or even one hundred points of insertion, varying in size from a quarter to a half dollar. These points are made by first scraping off the epidermis and afterwards making a number of scarifications in different directions.

Then comes the important step of the operation, placing on the vaccine. This should be done with the greatest care, as upon this depends your success or failure. It is truly remarkable what an astonishing number of failures can be obtained with the best virus, when this operation is not properly carried out. The animal after being vaccinated is placed in a warm stable and where there will be no danger of drafts or cold to which they are now quite susceptible, the stall in which they are placed must be wide enough to be comfortable, but sufficiently narrow to prevent the animal from turning, which it will invariably try to do, in order to lick the scarifications, which burn and sting very much.

Abundance of clean straw must be supplied and the fæces from the animals removed as fast as they fall. This insures cleanliness, which is one of the great essentials of success. We must not forget that the full product of vaccination should be obtained on the sixth day at the farthest, and in Europe where all the animals are slaughtered for food, they invariably go to the butcher on the seventh day or before the possible development of supurative fever.

It is a fact that the animals do not suffer through vaccination, never mind how numerous the insertions may be.

It may suffer from the effects of a journey, or from the ill treatment it has received from the change of stable or companions, but from vaccination never. Nor is vaccination ever a cause for depreciation in its value.

It is an unanswered question, why at, or during the vaccinal period calves are likely to be attacked with diarrhœa and tympanites. Diarrhœa will often yield to light and proper diet and some emolient drinks in a few hours; if it persists it may arrest, or at least delay vesication. Tympanites, which is a frequent complication, is nevertheless a disagreeable one. If this complication should arise at the beginning of the eruption, it modifies it at once. The vesicles become flattened, and may even disappear or dry up completely.

Should the vesicles be full when the stomach trouble comes on, the flow of lymph to decrease and in a few moments entirely disappear.

Lymph cannot be collected under these circumstances; on the contrary it is necessary to treat the tympanites and wait. A few hours often is all that is necessary for the skin to regain its softness and for the vesicles to return to their normal condition. Notwithstanding the great care exercised to prevent the vesicles on the belly

of a heifer from being torn or broken, they will be more or less injured.

This is an inconvenience difficult to avoid, but the importance of which need not be over estimated.

If the surface of the vesicles are torn, they need not on this account lose either their contents or their intrinsic value. For this reason there is no necessity to try to avoid this accident of tearing, as could be done by placing a pad over the abdomen of the animal and by changing the ordinary litter for a floor with an opening which will allow the escape of excrementitious matter.

The greatest danger to the vesicles however, and one which must be carefully guarded against, is, that the animals will lick the wounds and thus wash away the vaccine just deposited there. This itching sensation which cause the animals to lick themselves, is evident immediately after the vaccination and during the eruptive stage. We can avoid this means of sterilization and bruising by placing the animal in a stable, in which she cannot turn, or by putting on a muzzle. For the same reason it is always advisable to secure the tail of the animal, which can easily be done by placing a splint upon it thus preventing the animal from bending its tail. This simple procedure to a great extent lessens the ease with which the animal approaches its mouth to the vaccinated region. The development of the vaccine vesicle is a phenomenon with which you are all familiar. I will therefore not dwell here in order to describe it.

The collection of the vaccine lymph is a procedure which requires a great deal of care and judgment, or you will be likely to collect nothing but inactive serum.

Vaccine lymph is nothing but serum holding in suspension small spherical bodies, *micrococci*, which constitutes the active principal of the lymph. The presence of these bodies gives to the lymph a thick sticky mucilaginous character.

This gummy feel is altogether wanting in serum, which has not the active principal of vaccine in it.

The lymph may be collected from the vesicles under pressure of forceps made for this purpose, the use of which is not by any means an objectional feature.

After the scab and other foreign matter has been removed from the vesicle, they should be gently pressed with a clean linen rag slightly damp and should blood flow it must be removed in this way until it has entirely stopped.

In a few minutes serum or lymph will start, which may be recognized by the following test: That is to take a small quantity of it between the fingers and thumb; if it is sticky as a solution of gum, it is *prima facia* evidence that the lymph is good, but if this sensation or condition is not to be had, then the vesicle must be abandoned.

If it is desired to collect the vaccine lymph in tubes, it is allowed to

form on the surface of the vesicle in little pools and in the pools thus formed we may place a vacuum tube, or a capillary tube open at both ends, which soon becomes filled.

Such tubes, however, are of little value, as they become useless in a few hours. When mixed with equal parts of distilled water and glycerine, it may keep five or six days.

GLASS PLATES.

Those which I have seen were prepared by English propagators of vaccine lymph. As a means of preserving vaccine in a liquid state, it belongs to past ages and should certainly be relegated to them, so that its place may be supplied by other more certain and more practical methods.

IVORY POINTS.

This is certainly the best method of preserving animal vaccine in a dry state.

These points when properly prepared will retain their activity for three or four weeks.

In every instance the points should be double charged, the second charge must not be made from the animal which supplies the first.

This gives greater security, for should the first charge have been made from a negative animal, or from a negative vesicle, only by the slightest chance would the second charge be of the same character.

Points destined for a long voyage are triple charged and are afterwards dipped in a solution of gum arabic and the whole covered with tin foil.

VACCINE IN PULP—THE VESICLE ALONE.

This barbarous practice was used in the early days of animal vaccination. It consisted in excising the vesicle with a portion of skin down to the subcutaneous connective tissue. As far as the results of this method are concerned, I have nothing to say—as with an execution, it is merely the brutality of the practice. The wound made on the abdomen of the animal, from which blood flowed in streams, and the uncanny appearance of the piece of skin, scarcely an attractive thing to place under the eyes of the person to be vaccinated. But in order that the results of this practice be satisfactory, it must be used at once; if placed on one side for use at any period more or less remote, crowds of inconveniences present themselves.

GLYCERINE PULP.

This method consists of using the whole vesicle. It was first introduced in Milan, when they excised the skin with the vesicles, which they fix to a board with strong pins. The vesicles are scraped and with this scraped skin they make a glycerinized pulp or paste. This is placed in a bottle and a little pure glycerine placed on it, which acts as a coat or stopper to exclude the air.

This pulp was improved on by Warlomont, by removing from the surface every impurity, even the so-called vaccine scab. After this is done, he says that by a special process, the core of the vesicle is reduced to a thin mass; this is treated with glycerinized water and the emulsion obtained is put in cylindrical tubes of amber colored glass.

This emulsion keeps so well, that he advises vaccinators to habitually carry one of these phials in their cases for use at times of need.

While doubtless this emulsified animal tissue, and this is what it must be if it is the scraped vesicle, may be good enough for European practitioners, but I would not ask an American practitioner to use any such compound.

I believe that I have made a glycerinized vaccine, which is very much better than Warlomont's, even as much superior as his is an advance on the old method of using the entire vesicle.

The process is remarkably simple and there is nothing wonderful or exciting about it.

The first step is to thoroughly cleanse the vesicle of every particle of foreign matter, and as the pure, clear lymph wells up from the depths of the vesicle, to collect it in a small spoon. It is impossible not to collect shreds of tissue and foreign matter at the same time. The lymph as collected is placed in a small phial and an equal weight of chemically pure glycerine is incorporated with it. This is afterwards filtered, not only making a beautifully clear liquid, but also removing all foreign matter.

This solution, or glycerole of lymph, will keep and be absolutely sure in its results for a number of months.

XXXII. Importation of Foreign Rags into American Ports.

By F. S. Wilson, M. D., *of Jarrettown, Pa.*,
Late Lazaretto Physician at the Port of Philadelphia.

The people of Philadelphia are to be congratulated in that the State Board of Health, under whose auspices this convention is held, selected this city for the holding of such an important convention. Anything that concerns the public health is important, and any meeting or convention that has for its object the enlightenment of the public upon any matter or subject that ameliorates its condition while sick, or protects it from danger while well, is one that not only appeals to the highest intelligence, but the careful consideration of any community. Philadelphia, a city that long ago took the front rank in medical science, and still maintains it by her encouragement and fostering care, has been prompt in aiding all scientific enterprise; it is meet, therefore, that this convention should be held within per pre-

cincts. The subject which I have been selected to discuss in this paper is "Importation of Foreign Rags into American Ports," and I would that it had been placed in more able hands. The subject is one of considerable interest to health authorities, and in the past has been the cause of much embarrassments to quarantine officers. More than a year ago I addressed a letter to the Secretary of the Treasury, giving my views upon the subject, and perhaps my position then will be better understood if I read the letter and reply in full:

"JARRETTOWN, *March 17, 1885.*

"HON. DAN'L MANNING,

"*Secretary of Treasury Department, Washington D. C.:*

"SIR: In view of the possible advent of cholera into this country this season, I would respectfully call your attention to the subject of rags from infected ports. It is a subject that not only concerns the public, but more particularly is it a cause of anxiety to all conscientious quarantine officers whose duty it is to protect the public from pestilential disease. Last season in the exercise of my duties as Lazaretto physician for the port of Philadelphia, I had little to fear from this source, from the fact that we had very little shipping from any of the infected ports; and as cholera did not appear in France; until the 10th of June, and the subsequent order of your predecessor, the late Secretary Folger, placing an embargo for three months on the importation of all rags, left us little to fear for last season. But this season the conditions and circumstances governing the case will be quite different; the collectors of rags in France, Italy and Spain whence cholera appeared last year will have had ample time to collect them and get them baled preparatory to shipment. To stop the importation of rags for a limited time does not solve the difficulty nor avert the danger; for it is a mooted question with medical men and sanitary experts, how long the germs of disease may remain active in rags or any other nidus, and while they may not agree as to the exact time the poison continues to be virulent, I believe they all agree that its potency is not lost under a year. To stop the importation of rags for a long period would seriously cripple one important branch of commerce and greatly interfere with a large industry in this country, that of papermaking. To overcome this difficulty there should be some feasible plan whereby all interests could be subserved, and I think there is; and hence would respectfully suggest that an order might issue from your department to all United States Consuls and consular agents abroad that no rags could be shipped to this country from countries where cholera did exist or had existed last year, unless they bore a proper and legal certificate from the above officers that they had been thoroughly and effectually disinfected, or, what in my opinion would be decidedly preferable, that they had been reduced to pulp before they were shipped. The rags that are imported are

used in papermaking and if they were reduced to pulp before being shipped, the reduction would most effectually destroy all the germs of disease that they might contain and not interfere with the object for which they are imported, and the cargo become as harmless as one of iron or stone. To have them disinfected after they reached this country would entail considerable labor as well as expense. They are shipped in bales, tightly compressed, each one weighing from four hundred and fifty to five hundred pounds; these bales would have to be undone to be properly disinfected, and various places would have to be established in this country for disinfecting purposes. I think the most feasible plan would be to compel the shippers to have them reduced to pulp before they are shipped to this country.

"All of which is respectfully submitted.

"F. S. Wilson,
"*Lazaretto Physician, Jarrettown, Pa.*"

"Treasury Department,
"Washington, D. C., *March 23, 1885.*

"Dr. F. S. Wilson,
"*Lazaretto Physician, Jarrettown, Pa.:*

"Sir: In reply to your letter of the 17th instant I enclose herewith a copy of this department's circular of December 22d, 1884, which prescribes the mode of disinfecting old rags imported into the United States, and have to state that should a modification of such instructions be deemed necessary at any time the suggestions contained in your letter will be duly considered.

"Very respectfully,
"Charles E. Coon,
"*Assistant Secretary.*"

Since then the Treasury Department, believing that the question belonged to the local health authorities exclusively, has divested itself of the puzzle and thrown the responsibility entirely upon the latter. Since writing the above letter, in a conversation which I had with a paper manufacturer, he took the view that if rags were reduced to pulp before being shipped it would destroy them as an article of commerce. However that may be, from such *ex parte* evidence, I am not prepared to say; but I do know that such a process would render them entirely safe, a consideration not unworthy the best thought. Cargoes of old rags have always been looked upon as suspicious in European ports, and now, when we know that cholera has raged in portions of Europe for the last two years, that suspicion deepens here into the conviction that such cargoes, without disinfection, are unsafe and should not be received into American ports. Whether cholera is dependent upon the *comma bacillus* of Koch, or the bacteria of other investigators, I am not prepared to say; nor do I care, believing that this is not the time nor place for such discus-

sion. It is not my purpose to deal in glittering generalities, or to weave fine-spun theories in regard to the etiology of this disease, leaving for others the task of clearing away the mist that surrounds its cause at present, and to content myself with trying to prevent its introduction into this country.

But if we are to accept the germ theory of this disease which at the present stage of scientific experiment seems to be the most probable, then we know we have in rags a most convenient as well as efficient vehicle for the transmission of such germs. In further illustration of this point let me here relate what occurred in my own private practice more than a year ago. I was attending a case of malignant scarlet fever in a child, whose mother at the time was also sick of a non contagious disease and who subsequently died. Two months after her death there was held a public vendue on the household goods and effects, and among other things sold were some unsewed carpet rags which were purchased by a woman living two miles distant; shortly after this purchase she sewed the rags together, her two little daughters assisting her and in a few days thereafter both children were taken with scarlet fever, the elder of the two recovering while the younger died in less than twenty-four hours; a few days after this death another child, a boy fifteen years old, took the disease and died in twelve hours.

There were no other cases of scarlet fever in the neighborhood, and there had been none for a long period when this first case occurred, and there had been no communication between the children of the two families; and therefore the appearance of the disease in the second family, I think, was clearly traceable to the infection held in the carpet rags. Now, if such a condition is possible in a few carpet-rags, is it unreasonable to suppose that a similar condition might not exist in a cargo of rags? Rags have a commercial value, of which I am not unmindful, and for the following data I am indebted to the custom house records. For the year 1885, there were brought into Philadelphia one million six hundred and fifty-nine thousand three hundred and forty seven (1,659,347) pounds of rags (not woolen) carried as freight, whose valuation was forty-eight thousand nine hundred and fifty-six ($48,956) dollars; but this valuation is small compared with the commercial loss this city would sustain if visited by an epidemic of cholera; for such loss, even in dollars and cents, not saying anything of the loss of life, would not be measured by thousands but millions, and who would be able to calculate the withering influence of such a blight, or estimate the wide-spread misery and desolation that would be left in its wake. Far be it from me to say one word or do one act that would in any way cripple the commerce of this port, or paralyze any branch of it, for pr de for my native city, if guided by no higher motive, would preclude the possibility of such action; but if I am called upon to choose between the annihilation, if need be, of one

branch of commercial industry and the protection, welfare and safety of nearly a million of people, then I have no hesitation in declaring publicly that I am for the safety of the people first, last and all the time. The health and safety of the people are paramount to everything else, and it should be the first consideration with all boards of health, health officers and quarantine officers to keep this steadily in view, and so execute the health laws to meet this end. A board of health is nothing if not positive. A quarantine officer also is nothing if not positive. Health laws generally are stringent, and made for the benefit of the people at large, and must be executed fearlessly, though minor interests suffer. But it does not follow from this that determination cannot be coupled with civility, that decision cannot be rendered without giving offence, that maintenance of the law cannot be had without the loss of gentlemanly instinct.

This question of the importation of foreign rags into American ports must be met and met boldly too; and now, it is no time to delay in the matter, there is no half way ground, we must either admit them under restriction or exclude them altogether. What is the remedy? Speaking from the standpoint of a quarantine officer, I would say 'admit them under certain limitations and restrictions, which it is the right and bounden duty of the health authorities of this country to impose,' and if the shippers of these rags will not conform to this rule, then I would exclude peremptorily from every American port every pound of rags. The question will be asked, perhaps, of what are these limitations and restrictions thus imposed to consist. I answer, thorough disinfection of the rags before being baled and before being shipped by such processes as the health authorities of this country shall prescribe. Happily the Board of Health of Philadelphia has recently passed a resolution embodying the points which I have just been considering, and so long as I shall have the honor to represent Philadelphia in my present capacity, it will not only be a pleasure but I shall consider it my imperative duty to enforce that resolution without fear or favor. It is to be earnestly hoped that every board of health in the United States will take up this subject and treat it in the manner in which the Philadelphia Board of Health has, so that there will be coöperation all along the line, and that harmony of action upon it which its importance demands. In the performance of sanitary work we need the encouragement and coöperation of the people and no matter how difficult the task, how heavy the burden or how great the danger, if we know that the people are with us in invoking the majesty of the law in upholding our authority, it lessens the task, lightens the burden and conceals the danger. One can appreciate the responsibility a quarantine officer assumes when it is considered that he stands as a wall of fire between pestilence and the population of a large city; but even this responsibility becomes less irksome when he knows that the people are back of him, ever ready to uphold him in

the prosecution of a good work. And here let me say, if you will pardon the digression, that too much praise cannot be given to the State Board of Health for the pains and care it has taken in getting up this convention to familiarize the people of this city with sanitary work.

So also is much credit due the Philadelphia Board of Health for instituting that house to house inspection last year, and whose order in reference thereto was so faithfully and fearlessly carried out by her efficient health officer, reinforced by the scientific and chemical knowledge of her learned port physician; the work was well conceived and well executed, and will no doubt result in lessening the number of cases of zymotic disease.